

The University of Michigan

Some Imaginal Factors Influencing Verbal Expression

A DISSERTATION
SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY
IN THE UNIVERSITY OF MICHIGAN

DEPARTMENTS OF RHETORIC AND PSYCHOLOGY

By
ESTHER E. SHAW

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This work was done under the direction of Professor John F. Shepard, and was made possible by the hearty co-operation of those who acted as subjects.

TABLE OF CONTENTS

	PAGE
Chapter I. The Problem and the Method of Attack	I
Chapter II. Mental Diagnosis. The Preliminary Experiments.....	10
I. Reading of descriptive passages.....	10
II. Spelling backwards and pronouncing from words spelled back- wards	18
III. Letter squares	21
IV. Words that sound alike but are spelled differently.....	24
V. Word lists	25
VI. Words that are spelled alike but sound differently.....	29
VII. Picture material	30
Summary	50
Chapter III. The Free Word Association Test.....	53
The times	53
The verbal element	56
Parts of speech	58
Concrete imagery	60
Verbal imagery	63
Types of imagery illustrated	68
Unanalyzable mental content	70
Influence of kind of word	74
Summary	75
Chapter IV. Individual Diagnosis Records	76
Chapter V. Experiments Dealing with Verbal Expression and with the Mental Processes Preceding It	96
Description of the experiments	96
Objective results	99
The time records	99
Nature of the vocabulary	102
Literary excellence	106
Mental content preceding expression	107
Verbal imagery	107
Judgments	115
Genesis and form of sentence	118
Chapter VI. Conclusions	123
Appendix. The Preliminary Experiments	130
Bibliography	137



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CHAPTER I

THE PROBLEM AND THE METHOD OF ATTACK

This study was undertaken to see if any definite and valuable relations could be established between an individual's type of mental imagery and his ability to express himself in oral or written language.

Classroom experience shows a great degree of variation in the power of quick, effective, and pleasurable expression in words on the part of students who are apparently equally intelligent and similarly trained. Some have a facility in the use of words which seems to be a dangerous thing, a temptation to superficiality and confusion. Others "have the idea but can't express it," or not immediately. The stock reply of the teacher, "You mean that you haven't any idea to express, or that it is too vague for expression," though often, no doubt, an accurate diagnosis, does not seem to apply in all cases. Another explanation of the student's inability to express himself, the effect of which is to make all clear thinking verbal, is implied in such statements in the rhetorics as the following by Arlo Bates:¹ "Every student should learn . . . that it (literary form) is an absolute essential of all clear thinking." A number of teachers, asked what part of the process of thinking they conceived of as taking place in words, answered, in the words of one of them, "Thinking and wording are one and the same process." That literary form is essential to all clear understanding on the part of the listener may be granted; whether it is essential to clear thinking is certainly open to question. Intelligent and observant scholars seem to have had experiences similar to those of the inarticulate student. For example, Jespersen² says: "If you have to speak on a difficult or unfamiliar subject on which you would not like to say anything but what was to the point and strictly justifiable,

¹ Bates, Arlo, Introduction to Pearson's Freshman Composition.

² Jespersen, Progress in Language, pp. 23-24.

tion. If certain relationships between imaginal factors and characteristics of verbal expression remain constant through great temperamental and environmental diversities, then the temperamental and environmental factors would seem to be shown to be separable and independent.

The subjects for these experiments were, accordingly, chosen from men and women interested in rhetoric and in science, because it was thought that they would represent varied types of mind, one group especially interested in expression in language, the other dealing primarily with non-verbal material. The first group consisted of four graduate women, one senior woman, and three instructors, men, from the rhetoric department; the second group included two graduates, a man and a woman, and an instructor, a man, from the psychology department, a woman from the zoölogy department, and a woman from the chemistry department. The average age of the subjects was 27.7 years, the ages ranging from 23 to 33 years. One of the rhetoric instructors, By, had been a newspaper reporter, another, Ev, had been for some years a cartoonist. H, E, By, and Ty are writers of verse. T is a zoölogist doing some scientific writing. By and Ty are distinctly musical, Y, T, and B distinctly non-musical. A acted as a subject for Miss Fernald. All were students or instructors at the University of Michigan during the years 1914-15 and 1915-16.

It was decided to use for this preliminary testing the experiments which Miss Fernald had tried and found most successful, with some modifications due to the difference in aim. More emphasis has been put on introspection, and various changes introduced as the experiments proceeded.

The reliance upon introspection, especially where some of the subjects used are not trained to it, may seem to some unjustifiable. But it seems to the writer more and more evident that if we are to discover anything more about the human mind than about the animal this method is necessary; that it would be foolish to throw away the opportunity afforded to us by human speech, that being quite as much a form of behavior as anything else, and, unless the subject is quizzed and led on by suggestion,

just as truly a form of reaction to stimulus. The subject's greatest difficulty in introspection is to keep the form of the idea as it occurred during the period he is examining, separate from the development which takes place afterward. Immediate introspection, over a very brief and clearly defined period, decreases this difficulty.⁶ What is it that goes on in the mind between the stimulation of the idea and its expression to an auditor in words? is the question to be answered. For the purpose of this work it is just the course of development of an idea, and the forms that it is capable of taking, that are of interest; the introspection, therefore, in all the later experiments is taken to the end of the expression process, with as careful discrimination of the periods in the development and of the chronological order of it as the subject can accomplish. The conditions, though as far as possible under experimental control, were made as little mechanical, as much like ordinary human intercourse, as possible. This seemed especially necessary in the last group of experiments, where otherwise the conditions of natural speech would not exist.

The experiments fall into four principal groups. The first, or preliminary group, is primarily for the purpose of mental diagnosis, and, as has been said, repeats a number of the experiments described by Miss Fernald. All these experiments were accompanied by introspections, which not only supplemented the objective results but furnished practice to those subjects who were unaccustomed to the task.

PRELIMINARY GROUP

I. The first experiment consisted of the reading of descriptive passages,⁷ four read in as normal a way as possible by the subject to himself, two read aloud by the subject, and two read by the experimenter to the subject. The number of passages used and the method were varied more or less; several of the tests were followed by reproductions and all by oral or written introspections. This experiment seemed well adapted to bring out

⁶ Ach, *Willenstätigkeit und Denken*. Kapitel I: Methodik. Die systematische experimentelle Selbstbeobachtung.

⁷ For passages used see Appendix.

such concrete imagery as might be suggested to the subject by words.

II. The second was given primarily to bring out visual-verbal factors, and consisted of spelling backwards, and pronouncing from words spelled backwards.

III. This consisted of a series of memory tests, based on arrangements of Roman and Arabic numerals, letters, and other symbols, for example—

B	4	t
=	m	XI
iii	\	1

exposed for ten seconds, and designed to show whether visual images were employed in learning.

IV. Experiment IV was a list of words alike in sound but not in appearance, designed to show whether or not the subject was able to use visual-verbal imagery in learning.

V. Experiment V consisted of making lists of rhyming words, to bring out auditory-vocal-motor imagery, and lists of words with a common ending, like *-one*, to bring out the visual factor that seemed to be naturally involved.

VI. The memorizing of words similar in appearance but not in sound, was intended, like the first part of V, to bring out the auditory-vocal-motor complex.

VII. Experiment VII consisted in reports on the content of pictures and in the analysis of the imagery involved in learning and recalling this content.

When it was felt that a good working idea of the imaginal types of the subjects had been gained, a test in free word association was added, to see (1) if any influence upon imagery of the kind of word given could be detected, (2) what relation the times bore to this and to the general type of the subject, and, more especially through introspection, (3) what sort of mental processes went on during these periods of concentrated attention—for instance, whether concrete imagery having to do with the reaction word ever preceded that word in consciousness. This test consisted of one hundred and thirteen words, chosen largely from what might be called a literary vocabulary, though

including a group of simple words from everyday speech, a small group of rare words, and a few distinctly scientific terms. These words were considered to belong roughly to five classes:⁸ (1) *objective* words, nouns and verbs, referring directly to material objects or physical actions (carrot, paddle); (2) *sensuous* words, mostly adjectives, that were felt to be especially likely to stimulate simple sense imagery (scarlet, hum); (3) words, mostly adjectives, that denoted characteristics or *attributes* of a less sensuous, or more complex nature (majestic, humble, severe); (4) words, mostly nouns, which on account of their literary history or the circumstances of their daily use are capable, as Pater⁹ says, "of stirring a long 'brain-wave'" of associations behind them, that is, words of great *connotative* power (myriad, turf, treasure); and (5) words of a highly *abstract* sort, removed as far as possible from sensational stimulation (also, function). Some words (prose, omnibuses, broadens) used in former experiments were included; and a good many were chosen because of a likelihood that they would evoke others of the same quotation or stock phrase (braes, tide). A Hipp chronoscope and a modified Wirth apparatus were used in this experiment, and the times were carefully kept.

The experiments of Chapter V are an attempt to examine mental processes from the arousal of an idea to its expression in verbal form, either spoken or written. These experiments, that is, have to do directly with the problem: to discover whether any valuable correlations appear between the results of such experiments and the previously determined imaginal types of the subjects.

The experiments of group III are based on picture postals shown by means of a simple mechanical device, in an attempt to produce fairly natural verbal reactions. In series 1, eight cards were shown and the following direction given: Immediately after the word 'ready' is spoken a picture postal will appear; you

⁸ It is unfortunate that some of the terms used in classification, as *objective*, *attributive*, *connotative*, *abstract*, are from a logical or philosophical vocabulary. They are used by the writer in default of better, to express various degrees of a possible power to evoke a sense stimulation or image.

⁹ Pater, Walter, *Style*.

are to respond with the first thing that comes into your head to say about it. When the response came its time was noted by means of a stop watch, the card covered, and an introspection asked for. Series 2 consisted of ten cards in groups of five each, chosen so that the cards of the two series were as nearly similar as possible in interest and in type and complexity of subject matter. The direction for the first five asked for a complete statement, oral, embodying the impression or opinion of the subject. This was followed immediately by a timed introspection. For the second five the subject was directed to turn in his chair as soon as any statement came to mind and write it, following immediately with an introspection. 3 is a set of four cards for each of which a different direction is given, the intention being to get a written description under something like the conditions of theme writing. The time of writing is taken with a stop watch. In 4 the cards are described orally and a short-hand account and the times taken.

The last group, IV, was planned to provide a more real-seeming subject matter, and used objects instead of cards. The objects were exposed by turning on a light over a table in the next room, the room in which the subject sat being in darkness except for a desk light. The subject was asked to react with a complete statement to some of the objects, and to write descriptions of others. Some of the objects would be more likely to produce simple sensations, and others a process of identification, of a less automatic sort than appeared in the preceding group. It was felt also that certain of the subjects would be more interested, and thus more fairly tested, by the use of such material.

LITERATURE

So far as I know, nothing has been done upon this particular problem. A great deal of work has, however, been carried on along two closely associated lines: in the study of imagery types and in the study of thought processes. Much has been done upon types of mental imagery, but rather on the forms in which material is learned and retained than upon the expressive side

of the process. I am indebted to all earlier workers in this field, and especially to J. R. Angell and M. R. Fernald, whose experiments and conclusions in the field of mental diagnosis I have used freely. The work most nearly approaching this in aim and in method, is that on thought processes done at Würzburg by Marbe, Ach, Watt, and Messer; Pillsbury's consideration of the mental antecedents of speech and Crane's study of association reaction, at the University of Michigan.

CHAPTER II

MENTAL DIAGNOSIS

The preliminary experiments.

I. Reading of descriptive passages.¹⁰ Subjects differ greatly in the amount, kind, and clearness, etc., of the imagery called up by the descriptive passages which they read or had read to them.

The following reports of visual-concrete imagery illustrate the differences very well. The series from (1) particularly, gives the typical differences of the subjects in the amount of detail and in clearness and completeness of the picture.

Ev. (1. Jefferies. Description of street corner.) Accepted the passage with perfect confidence that I could put it into images, that it was well done and suggestive. Recognized as color description rather than saw colors.

R. (1) More schematic than anything else. Saw vehicles, pale yellow straw.

B. (1) Got triangle and succeeded in rounding off apex. Dim visual image associated with Detroit. Dark mass of forms, indistinct. The carts were very diminutive and wouldn't fit in.

H. (1) Saw carts and streets and movement. Saw high fat things for omnibuses. For "high white wool packs" saw brown sacking with bits of white sticking out.¹¹

Y. (1) Scene was quite maplike in definiteness, but small as if viewed from a window above the street. (Speaking of color) Saw especially the red and green, and the shine on the varnish.

T. (1) Saw an imaginary scene which kept overshadowing the described one all the time and becoming more prominent.

¹⁰ See Appendix.

¹¹ It is perhaps significant that to Ev with his method, the passage appeared "well, done and suggestive," to H who had a great deal of confused visual imagery, not to speak of auditory, etc., it appeared "overloaded," "forced."

...Saw Ogden and the station there after a bit, and the carts, etc., filtered away. It was difficult to get details into this setting. There was also a picture of Miss P. feeding the doves in front of St. Marks. Description of vehicles was too mixed... had to read sentence over. Seeing the mountains at Ogden went easier than trying to get traffic... The horses that were champ-ing their bits were nice black sleek horses in coach harness, guards on bit—one, double below with basket work, very ornamental. Lots of foam on horses' mouths. (No conscious effort to visualize.)

S. (3. Scene from *Esmond*.)¹² Saw white round arm, large, quite out of proportion to figure, persisted as image by itself.

B. (3) Got Beatrix coming down stairs, train appeared in three ways. Saw red stockings and white shoes, separate from Beatrix and from one another.

Ev. (3) Visualized more or less because questioned on first one. Saw only very fleetingly. I can draw from these descriptions in novels—can “see the edges.”

H. (3) Saw Beatrix moving in full, shining clothes, with lighted candle. Scarlet stockings show. Saw her advance to *Esmond* and draw back. Swept curtsy almost to the ground, looking up with eyes and teeth shining. Staircase wide and shining out of dark. Saw turn of landing.

Ev. (4. Stanza from poem.)¹³ Reported no visual imagery.

R. (4) Reported no visual imagery.

By. (4) Thought very dimly of woods, camp fires, and wild places.

B. (4) Saw birch log in fire place. Got distinct visual image of self in bed at night, awake and tense. “Young men” just vague forms.

S. (4) Got general picture of woods at night, saw smoke, camp fire, and birch log—part of the time the log was in a fire place, though. (The visual was not the important imagery in this experience.)

¹² See Appendix.

¹³ See Appendix.

H. (4) Got picture of recruits going down to St. Pancras station at night.

Y. (4) Subject quite naturally described the picture she had seen. Says that in general she remembers from poetry a picture, not the rhythm or words. Gets this picture "independent" of words—probably in sense of separate form—"as vivid as actual thing seen." The fact that subject very evidently did not get rhythm bears out her judgment.

Visual imagery varies in amount, mobility, definiteness, fitting-together-ness, and in the character of its color; and these are apparently independent variables. H, for instance, has a great deal of mobile, fairly definite, bright-colored imagery, making a related whole; B has a little distinct and immobile and a fair amount of indistinct imagery, which when distinct does not form a related whole. Imagery appears also to vary in the accuracy of its reflection of the passage that stimulated it. Sometimes the associations called up by a single word or phrase control all the rest (T and H). It is something of a question whether a distinct picture called up in mind by the words read, as in the case of Y, or the clear visual imagery called up by association, as in the cases of T and H, marks a higher degree of visualizing power. It seems probable that the latter is at least a clear indication of the effective habitual use of visual imagery, of a high degree, that is, of persistence of visual memory.

The types of imagery reported by individuals seem to differ as much as the type may vary within its self. Except in the stanza (4) with its definite appeal to olfactory imagery,

"Who hath smelt wood smoke at twilight,"

no trace of such imagery is found, and there only in a few individuals. In at least two other passages an opportunity for such imagery was offered, in (5),¹⁴ read by part of the subjects, where the line occurs

"Like pious incense from a censer old";

and in the description of sea and earth, (6).¹⁵

¹⁴ See Appendix.

¹⁵ See Appendix.

B. (4) Had consciousness of smelling, kinaesthetic sensation.

Y. (4) I got name, woodsmoke, and saw it, got tang of it but not first hand smell—the fact, rather, of what the author wanted me to sense.

R. (4) Image of smell.

E. (4) Smell damp wood smell.

Ty. (4) Conscious of something acrid, pungent, delightfully woodsy, in the beginning. Choked by woodsmoke rather than smelled it.

Auditory imagery, apart from the auditory-vocal-motor complex, was reported fairly freely and with certainty by two subjects only, R and E, but occasionally by nearly all.

E. (7)¹⁶ Heard the whirr of the waltz clock before it started even; (4) heard the wind. (Likely to hear everything she reads in a low-pitched woman's voice, not at all like her own.)

R. (1) Heard the "jingle, jingle, jingle", also heard a Christmas carol, and the horses' hoofs on smooth pavement; foreground was sound, background sight; (4) auditory memory of the rhymes; (6. Asked to reproduce what he got from it.) "The wheat which *crackles* in his hand," "sea, bright blue and *booming* lazily on the beach."¹⁷

S. (3) Heard intonation of voice during Frank's speech, almost making sounds to myself.

T. (1) When asked about the effect of the word "jingle" reported: The noise in this passage was not a jingle, it was *clatter*. I heard the horses' feet on pavements.

B. (1) After the thought, I should be getting imagery here, got faint jingle off in corner.

H. (4) Heard the birch log burning; you couldn't help it.

The near auditory imagery reported is interesting. It seems to be a mixture of sensations, kinaesthetic and organic.

S. (9)¹⁸ No auditory images except that the word 'pealing' gave a slight feeling of tenseness in my head, as though I were

¹⁶ See Appendix.

¹⁷ It is, of course, quite possible that neither *crackles* nor *booming* represents an actual sound heard, but they are at least typical of this auditory subject and quite different from any word used in the passage itself.

¹⁸ See Appendix.

straining to make a shrill sound. (7. read aloud by subject) "Sighs" and "chinks" by their sound suggested auditory images different from the sound of the words. I think the saying of the words acted as a spur.

Y. (3) Didn't hear conversation, but got a *ringing* impression different from what I would have had from pantomime.

H. (3) Got the feeling I would have had if I had heard the speeches, a sort of jolly, genial feeling of Frank, for instance; but can't say I *heard* anything.

Ty. (1) Noticed "color champed, as it were, like bits in the horses' teeth" as a desirably apt expression from literary workman's point of view. Recalled the phrase, no auditory imagery.

Sc. (1) For "champed," etc., thought of horse champing at a bit; thought of what it meant. ("Jingle, jingle, jingle, A... jingle," saw as it looked on page.)

Passage 8, the moving of crossed knife edges,¹⁹ which was expected to bring out auditory imagery, was much more fruitful of kinaesthetic and organic, even of tactual, sensations.

Ev. I squirmed. No sound. Not a matter of sound, a matter of edges.

B. I felt my teeth on edge. Did not hear it.

By and E got only visual imagery for some moments.

S. Physical reaction to grating, did not hear them grate.

Sc. Sharp feeling, sort of circularly located in upper body. (Much delayed.)

Rg. Got feeling of sharpness.

H. Very uncomfortable. Persistence of shuddering and teeth on edge sensations for some time.

R. Heard a swish of knives. Later, set teeth on edge faintly. (5) Vivid sensations of shivering.

Ty. The blades scraped *hideously*. (Delayed.)

In general those who got a visual image and were preoccupied with it, had a complex visual-motor process on their hands,²⁰

¹⁹ See Appendix.

²⁰ E. Just saw the knives, they sort of glistened, the blades together. They

and had no organic sensations unless at the close, much delayed. This reaction probably shows a visual preoccupation, resulting in part, perhaps, from James' phrasing, and in part from a less strong tendency toward organic reaction. (By, E, Ty, Sc, and S.)

Motor sensations were apparently an habitual form of reaction to two subjects, R and B, and much of the effect of rhythm and cadence reported was declared to be motor, By, a good deal of a musician, going so far as to say that his memory of music was altogether of that sort, though he was keen at recognizing or identifying musical sound. Sc gets a great deal of motor combined with visual in dramatizing,²¹ and uses gestures freely in giving introspections.

R. (4) "Don't remember poetry because I read rhythm instead of the words, accent for structure rather than content." (Of the smoke) "Rather felt it going up, as if I were the smoke." (6) "*Was* the man." (Subject in his reproduction added a good deal, both in meaning and in content.) (8) Motor and tactual. R "immediately got in his place (the holder of the knives) and felt prick of knife." (5) Motor and tactual. Was moving rosary beads.

Rg. (4) All I'm conscious of is the rhythm. I'm conscious of it as a rhythmic unit.

E. (4) Knew it was Kipling though hadn't read it. "Nobody else swings a line over like that third one."

were moving supernaturally. Subject drew them as she said they looked, flats of blades together.

S. Saw two silver table knives, then realized that they were steel and rather deliberately changed image to "kitchen" knives.

Ty. Carried this adjustment through three stages: Two blades (picnic table knives) laid flat, sharp edges toward each other; blades suddenly turned so that sharp edges are in contact, blades being held stiffly upright, crossed in middle; blades begin to draw back and forth, turn thinner and sharper.

Rg. Saw shiny edges plainly, and black handles. Got them parallel; scissor wise; then crossed keen edges at right angles.

²¹ Sc. (3) Had all in position, but Beatrix was only one really imaged. Resented phrase "almost to the ground" as too strong. "I made her do it in a way of my own." (Motor, or possibly visual-motor.)

H. (4) Calls up a similar rhythm—Robert's *Vagrant's Epitaph*.

Ev. (4) Got a sort of tripping motion.

Some of the sensations reported seem to be more properly described as kinaesthetic sensations of weight, strain, pressure, etc.

B. (4) Kinaesthetic for "feet are turning." (2) Kinaesthetic aroused with "take the field," and "transport his army," a certain feeling of strain as if I were picking them up and transporting them.

Ty. (3) I stood squeezed up against the wall.

Feelings like the following are hard to classify, but seem to those experiencing them to have an imaginal or sensational content.

E. (1) Felt as I feel sometimes in a crowd. (4) Felt Esmond (his presence). (7) Felt Markheim's strained mood.

S. (4) I was principally conscious of a thrill or a lure, suggesting at once Walt Whitman, the Open Road feeling. I think the words "Follow" and "turning" gave the lure feeling, although they were not in mind at the time. (Of a passage from James): Recognized passage was from James and had "last year Vassar" feeling, to some extent a feeling of locality. I was somewhere off to the left. (Very typical.)

B. (1) Conscious of effort. (2a) The word "king" gave a feeling of nobility.

Ty. (8) Felt as if I were in danger of getting between them (the knife blades). (3) Impression of elderly stout gentleman—of dignity and bulkiness.

Rg. (4) Underlying association of White Mts. got by means of fireplace in our cottage.

Very often the subject was unable to analyze his mental content but reported something very definitely there. The word unanalyzable, used to describe mental content, indicates this inability on the part of the subject to analyze, to carry introspection further.

Ty. (4) Disappointment—when found that they were to *leave* for camps.

Sc. (3) Resented a phrase employed. (Because it did not fit his own procedure.)

H. (4) Disappointed in the end.

Rg. (4) Conscious of emotional atmosphere.

Sc. (4) Suggested Longfellow. Afterwards said it "savoured of *Hiawatha*."

E. Very sensitive to mood in all cases.

S. (4) Things mentioned bring a feeling without the interposition of any image.

Y. (4) I knew the stanza took form of questions at the beginning and a command at the end.

Ev. (1) Thought of mixed figure in wheel and pool without having images of either—or of anything else. I think I knew what the words meant—didn't stop over to get image. (Explanation of statement that he "had an idea what the streets were like.") Often recognize that thing is capable of being interpreted without interpreting it. (4) Got significance of words, no visual imagery.

B. (3) Indistinct feeling of female spectator at one side.

Ty. (4) Felt it a desirably apt expression from literary workman's point of view.

Sc. (4) Just got idea of last two lines, no imagery.

By. (2) Got a very definite impression of McClellan's character; got significance rather than events.

Rg. (2) Called up in mind a series of articles on Confederate and other generals running in *Atlantic* last year. Conscious of situation at time of reading. No analyzable imagery, except later of a printed page, but think that came during attempt to analyze.

Verbal imagery in this test was not a primary consideration, and, as usual, where auditory-vocal-motor occurred it was difficult to discriminate between centrally aroused sensations and peripherally aroused or articulatory.²² Reading a passage silently gave much better results for some than for others, especially

²² So far as any distinction can be made the phrase auditory-vocal-motor is used in this paper to indicate the centrally aroused, and articulatory to indicate the peripherally aroused sensations.

good for Ev, Ty, and Y. H and B were particularly successful in recalling the stanza (4) as compared with the prose (2). Y recalled the words of the stanza fairly well, but with almost no sense of their rhythm.

Number of details recalled from (2).

1st group: Y. 27 (familiar with territory), Ev. 19, Ty. 17.

2nd group: Sc. 14, E. 14, Rg. 14, S. 14, H. 13.

3rd group: By. 12, B. 11, T. 9, R. 9, By and R "not interested in material."

Words recalled from (4).

1st group: Ty. 31, Sc. 31, H. 31.²³

2nd group: B. 26, Y. 21 (remembers poetry as picture), Rg. 21 ("All I'm conscious of is rhythm.").

3rd group: E. 17, Ev. 15, R. 7; no visual imagery reported.

Several subjects reported visual-verbal in recall, especially in the case of proper names or other noticeably printed words. Sc (2) had visual-verbal imagery of the opening phrase, 'Throughout the winter of 1861-62,' and of 'maneuver.' He remembers vaguely how the names of the four rivers looked.

The criticism of I that grows most clearly out of the introspections is that the reading is either undirected—purposeless—or motivated unnaturally. The results are, therefore, as typical reading results, not very trustworthy. The possibility of certain imagery's appearing and the tendency of other imagery not to appear in connection with words are, however, satisfactorily shown. The least flexible types are E, Y, and T, visual-concrete, and Rg visual and motor; the most flexible, Sc, Ty, and By, using visual-concrete and vocal-motor principally.

II²⁴. Spelling backwards, and pronouncing from words spelled backwards, given to bring out visualizing power.

Spelling backwards, orally, grouped the subjects roughly into two classes, a class that used visual imagery a good deal, and a

²³ H said "dear, dear, dear," while writing rapidly. Did not seem to be in the least an inhibition. Points probably to verbal imagery unaccompanied by articulation.

²⁴ See Appendix.

class that used it little if at all. Of the visuals Ty, Sc, By, and T use the method effectively, making high records in time and correctness; S uses a mixed visualizing and pronouncing method—she wanted a blank space before her to visualize upon—and has a fairly good record; Y and E make slow times, ranking 9 and 11 in the list, and are poor spellers here as elsewhere. Y “sees the general shape of the word before beginning to spell it, but the distinct image of the letters only after spelling them out.” E wrote the words on a blackboard a syllable at a time and became very much confused. Of the articulatory or motor type, R has an average time record and for writing is perfectly correct; H, who has a time record corresponding to that of the visuals, says she has “a feeling of dashing at the words to set them running backwards on their own wheels, if you stop, the motion is gone and everything is lost” (a process apparently similar to Sc’s). Ev describes his method as phonetic and is constantly troubled by a sense that the process is wrong. B spells the word forward several times, and has, probably consequently, a very slow time, although the fact that she considers herself a poor speller, and is, undoubtedly contributes. As to visual imagery she reports, “when I look at a visual image of a word it isn’t there.” Spelling backwards in writing adds very little to the oral results. The objective results as to time are almost exactly similar. T is bothered by the sight of what she has written—“they got sort of upside down in my mind and I can’t read backwards from them”—and loses four places. Rg falls from 16.5” to 33”; she reports it “much harder” and covers written portion with her hand. R, who writes from right to left, is aided, and steps up three places. The per cent of words spelled correctly rises considerably, 10%; the great improvement is with the motors, and the great fall (30% B) is also motor.

Pronouncing from words spelled backwards gave the same rough grouping as the preceding test. E varied very much, her visual method giving quick times with short words, and very long times with long ones; with two letters per second her time improved markedly, apparently through the appearance of auditory

Table a.
Spelling backward. Time records for right spellings.

Subject	Oral		Written	Type
	Av. time in seconds	Per cent right	Per cent right	
Sc	7.6	55	100	Visual and vocal-motor.
Ty	9.2	80	88	Visual.
By	13.5	80	90	Visual.
H	15.8	50	100	Vocal-motor.
S	16.4	60	50	Mixed, visual and vocal-motor.
Rg	16.5	40	80	Mixed, visual and vocal-motor.
T	16.7	80	70	Visual.
R	20.2	70	100	Vocal-motor.
Ev	21	60	50	Vocal-motor.
Y	26	80	60	Mixed—emphasis visual. Poor speller.
B	27.2	80	50	Vocal-motor. Poor speller.
E	59.5	40	60	Visual, some vocal-motor. Poor speller.
Average	15.8 (without E) 20.8 (with E)	64.5	74.8	

aid. Y reports: "When I heard the letters I saw them upside down, tried to hold them all in mind and then turn the paper ground (on which they were written) around so that the word would be in normal position"; with one letter per second this process, though complicated, did not seem very difficult, with two letters per second, "guessed more." Of *rudimentary* Y reports: "Tried to see on blackboard right to left. Did not show till Miss S—— had finished spelling it. When she said d-u-r *rud* appeared on the board, and quite a way from it, giving the idea that the word was a long one, then came *ary*. *Rudimentary* then popped in. Even when middle letters are blurred you know whether they fit or not."²⁵ By reports that some peculiar combination of consonants and vowels identified nearly every word; when letters came two per second "there was usually nothing conscious but a guess." S reports a still more mixed method,—"In some cases I had to respell a syllable backwards. The *sound* ran in my head so that I could." Sc reports that he sees the word, knows how

²⁵ Good spellers appear to have paid more attention to words as groups of letters. Compare By and Y.

big it is, how many letters there are in it, and everything like that, "builds it up objectively, out in front," but he can not tell whether it is in print or writing.

B, of the vocal-motor group, reports that after trying several methods unsuccessfully she "reversed in some way not visual." Ev says there was a good deal of guessing in his results; "When the word ends I can think back over the last three or four letters and turn them around." R learned to spell the word backwards, usually from one spelling, lip-motor, and then was "disinclined to work out the word as I know I have it there for the working"; his times in consequence are long. In general, the advantage in objective results goes to the good guessers. Sc and Ty both reported that they often knew the word before I finished; Sc (*Belgium*) "wanted to cut in at l."

Table b.

Pronouncing from words spelled backwards. Time record of right pronunciations.

Subjects	Av. time in secs.		Type
	1 letter per sec.	2 letters per sec.	
Ty	9	8.5	Mixed, auditory - vocal - motor and visual. Guesses.
Sc	9.5	10.4	Mixed, auditory - vocal - motor and visual. Guesses.
By	10.9	16.8	Visual. Guesses.
S	16.8	10.7	Mixed, auditory-vocal-motor and some visual. Guesses.
T	17.7	20.9	Visual.
B	22.9	24	Vocal-motor.
Y	25.5	15.3	Visual. Guesses (2 per second).
Rg	26	38	Visual (many spellings).
H	34.5	53	Vocal-motor.
Ev	36.7	29	Wrong guesses.
E	39.3	25.5	Vocal-motor. First step slow, then guesses.
R	80.5	13.3	Visual. Improvement in 2 per second due to auditory aids.
			Vocal-motor, with articulation.
			Passivity after first step.

Individual differences, of temperament largely, enter into the results in the speeding up process of spelling two letters per second; some for instance, "like to take a chance," others find it hard to guess.

III.²⁶ This experiment in the learning of arrangements of

²⁶ See Appendix.

numbers, letters and so forth, has been much used by investigators to bring out visual factors. So far as easily analyzable processes are concerned, however, the method followed by most of the subjects of this investigation is pronouncing, articulatory; it is usually aided by various associative processes exceedingly difficult to analyze into any definite imaginal form. Our habitual use of an articulatory or pronouncing method for all memorizing of word and letter material seriously affects the value of the test for visual imagery; an individual who uses visual images freely, even visual-verbal when driven to it as in II, might use vocal-motor here from sheer habit. The associative processes, mentioned above, seem in many cases to play the important role in memorizing. The subject is not aware of either visual or vocal-motor elements, cannot tell how he learns, learns it "as a diagram," is "aware of relations." That is, these results bear out those of T. V. Moore,²⁷ in *The Process of Abstraction*, where he says: "besides the visual image there is something else which is a powerful aid to memory. And this is a more or less complete mental analysis of the figures, an analysis which it is utterly unnecessary for the subject to put in words. . . . And while the two may go hand in hand, they need not; and it is possible to memorize by either method." Again: "It is much easier to memorize by analysis to the exclusion of imagery than vice versa." I do not feel justified, however, in saying that this learning "by association" takes place "to the exclusion of imagery." Motor imagery is extremely obscure and difficult to detect, and imagery may be so reduced, so fragmentary, so complex in its combinations, that the subject is unable to analyze his mental content and becomes confused. The test might prove more valuable in showing those who make ready use of associations and relations than for anything else.

Measured by their success in learning the squares, subjects rank as follows.

²⁷ Moore, T. V., *The Process of Abstraction*, pp. 140-141.

Memory—Roman and Arabic numerals, letters, etc.			
Subject	6 item tests	9 item tests	Method of learning
	Av. no. recalls	Av. no. recalls	
B	6	7	Articulatory, visual associations.
By	6	6.66	Articulatory, probably mixed.
Ty	5.5	7.3	Articulatory, schematic relations.
A	5	5.2	Visual-motor.
Rg	5	4.66	Articulatory, some visual, meaningful combinations.
S	4.5	5	Articulatory, localization (visual-motor) associations.
Sc	4.5	6	Articulatory, visual. Perseveration in recall.
R	4.5	5.33	Articulatory, non-visual. Motor relations.
Ev	4.5	4.66	Articulatory and visual.
T	4.5	5.66	Articulatory, visual-motor lines; visual relations for 9 items.
E	4.5	4.66	Articulatory and visual.
H	3.5	5.25	Articulatory and visual, meaningful combinations.
Y		4.33	Articulatory and visual.

Those who used an articulatory method helped out by visual—a rather clumsy and detailed use of imagery, perhaps—seem rather more likely to come out badly in the objective results than those who used less visual and depended upon ‘schemes’ and other associative aids. With six items the results seem to show three distinct levels of ability to learn this material. With nine items this grouping, after the first two names, seems to disappear. Ty and H show the greatest improvement, T improves in the second test, and reports that the improvement is due to use of visual relationships. H shows great variation, from a perfect test with nine items, to three accurately placed, and four correct but wrongly placed in a similar set. She remarked in the second instance, “Why, there’s nothing there to say!” From which it may be inferred that her success in the first instance was due to her hitting upon a meaningful combination to repeat. Those who showed themselves capable of using visual imagery here are those who have used it in other tests, except that By does not *report* visual imagery here and does in all the preceding tests.

It seems probable from the introspections of III that the articulatory or pronouncing method of learning may give rise in the recall—in reproducing the diagram—to vocal-motor imagery.

IV.²⁸ Learning lists of words that sound alike but are spelled differently would, if anything, it seems, bring out any disposition on the part of the subject to learn this kind of material visually. From the results, however, it would appear that there is very little tendency to use a visual-verbal method in learning words; that, on the contrary, the habit of learning by a vocal-motor method is too strong to be overcome by the exigencies of the situation. The subjects all depended primarily on that method, though using visual images, sense combinations and other associations as aids. The results show marked differences in ability to get such material, however. Of the three who succeeded fairly well, B reports, "used visual as a check"; S, "made sense. In b. got lines 1 and 2 by association, just looked at 3 (all were right), figured what possibilities were left. Had fairly definite image of *heir*. In c. got help from visual"; By reports for c., "got first three by sense clause, corrected list by visual, the last was deduced." It would seem evident that all three used visual imagery to some extent, being much more conscious of a visual preoccupation in recall than in learning; all three used associations, and two "deduced."

Number of words recalled from lists of nine each.											
Subjects	B	S	By	E	R	Ev	H	T	Ty	Sc	Rg
Test a.	7	5	7	2	3	1	0	2	3	3	3
Test b.	6	9	5	5	4	4	4	6	6	4	5
Test c.	9	7	9	4	3	4	2	5		9	7
Average	7.3	7	7	3.6	3.3	3	2	4.3	4.5	5.3	.5

The middle group, T, Ty, Sc, and Rg all report some visual imagery. Rg improves her method somewhat; for b., "tried to hold together the sequence in sound with the difference in spelling"; for c. "used meanings." Sc reports of a., "had great deal of difficulty organizing"; of b., "Learned by saying columns, tried to get some way to group, sure 1 of column 3 began with y, remembered how it looked"; of c., "Got sense out of first column, visual helped, had it cold both ways. Could see 1. Put meanings (see T) into second column as went along. Thought of *sow* as pronounced *sow*. Knew visually that *aye* came last." It

²⁸ See Appendix.

seemed to the subject that he used both visual and articulatory all the time; his method improved. Ty reports for a: "skipped all about, paid no attention to order, tried to place by sound I guess. Remembered the first, the last, and the first of the second column—salient visual positions"; for b. "learned the sets of three and then looked to see where they came, learned first column, first word of second and third, and last of third." T tried a. by getting variations of order, vocal-motor; b. was learned "by saying the words over and by looking at them—took meanings into consideration, that is, tried to put together spelling and meaning and remember by the meaning the column it went in." During introspection the subject recalled that the first word in the middle column of three was *rays* instead of *raze*, "had a remembrance of the way your y looked as it came down there." For c., the subject made sentences and visualized, and didn't really get to the last column. I take it that the suggestion of sentences acted as a deterrent. On the whole, some degree of visual activity seems to be necessary to even a moderate degree of success.

E reports a good deal of visual. For a: "tried saying in order written, tried to get the three different kinds of *sent* by the way they looked." In recall, "I saw *cent* written and *ascent*. Saw the full *s* in *scent* and it suggested *ascent*. For b: "tried to remember the sound, tried to visualize the forms." In recall, "Heard them, in a different voice. Saw a woolly lamb associated with *ewe*, saw a *pear* on a tree in a garden, kept seeing *pair* in other places, hazy." The confusion of imagery, including a good deal of visual-concrete, may account for her comparative lack of success. This subject had trouble in concentrating on the task, not only here but elsewhere. B reports a purely articulatory method. Ev "couldn't do it," "meanings funny, may have inhibited, no visual." H learned "by saying"; she was much confused.

V.²⁹ The first part of V consisted of making lists of rhyming words, as many as possible to a minute; the test was planned to bring out auditory-vocal-motor factors.

²⁹ See Appendix.

TABLE A.

Rhyme words.	Ty	Y	S	B	By	R	H	Ev	T	E	A	Sc	Rg	Av.
home		5	6+lw*	4+lw	6	8+lw	7	8+lw	6	6	7	7	5+5w	6.25
speak	13	6	10	6	12	10+lw	9	9	10	5	8	9	9	8.9
case	9	5	9	4	12	8	9	12	6	7	7	10	7	8
hope		6		6	8	7	8	10	6	6	6	10	11	7.6
low	16	12+3w	12	11	11	13	15	14	10	10	10	15	9	12
Av.	12.6	6.8	9.25	6.2	9.8	9.2	9.6	10.6	7.6	6.8	7.4	10.2	8.2	

* w = wrong.

First group: Ev, Sc, Ty.

Second group: H, By, R, S, Rg.

Third group: A, T, E, Y, B.

The first objection to the grouping from the objective results that rises to the investigator's mind concerns E, who is, however, likely to rank lower than might be expected on account of general hesitancy and nervousness, and lack of close attention. The matter is complicated by her being a verse maker and more than ordinarily sensitive and effective in the matter of rhymes. Y, also, though no rhymers, is a teacher of English and might reasonably be expected to stand well in such a test. There is one factor brought out in the introspections of both that may influence their results, by distracting the attention somewhat from the task, and by increasing the time of the individual words.

Y. (Home) "As the words came to me I had a rather vague picture, not so much of the word as of what the word stood for. This was especially true of *Rome*, where I saw only the capital R, but had a distinct picture of the map of Italy." (Speak) "With all there was a background, an image made up partly of the way the word looked, partly, and more markedly I think, of occasions for which the word stood. In *meek* I had a general shifting picture of bowed heads. With the last three words came quite distinct pictures of the things for which the words stand, a plump *cheek* against a background of nothing, a generalized picture of a queer looking person, a *freak*, and the head—profile—of a bird, something like an eagle, for *beak*." (Hope) "All have more or less of a halo."

E. (Home) *Roam*—saw tramp; *dome*—"saw top of cathedral in Florence"; *tome*—"saw great big book with heavy covers, saw gilt on the leather." (Speak) *meek*—"very gentle looking per-

son's mouth." (Hope) *mope*— "saw relaxed figure"; *soap*— "heaps of bars of ivory soap." Subject checked as colorless such words as *go*, *know*, *cope*.

B, who from her vocal-motor tendency might be expected not to come at the bottom of the list, reports that many nonsense syllables came up (she was a laboratory psychologist and familiar with them) and inhibited the sense words, and that her process was purely articulatory.

Of the three who stood highest, Ty reports a little visual concrete imagery, but certainly not enough to interfere with the process, as in the cases of Y and E. Ev reports "a purely rhyming process," and Sc much the same thing. Sc used "certain likely consonants with the ending," after the words began to come slowly, and in the case of the last word (*low*) worked with *ow* for a long time, a visual suggestion from *low*.

Of the second group, By reports that he noticed no auditory or visual images, "words come very quickly and crowd each other out"; H thinks her rhyming is very largely auditory, "heard *ē(a)k* much more clearly than *ōn(e)* [Letters in parentheses silent], the sound is sharper." H also gets many associations with words: *beak*—"bird, neither word nor concrete visual image; just general idea of bird with emphasis on *beak*"; *mace*—feeling of king, also of spice—"impression of shelf where we keep our spices"; Wace—"associations with the beginnings of English literature, with a blue book by Mr. Schofield, lower left hand page, a class in English literature four years ago, and the look of the room and the feeling of teaching that class, all together and very vague." Words "have meaningful air even when nothing definite can be introspected." With R, the visual-concrete imagery accompanying the words died out as the process became more practised, and showed at all times a tendency to come up only when there was a hesitation of some kind: *gnome*—"saw one, a little fellow walking around"; *leek*—"hesitated over spelling and saw onion, long green stalks." His list for *low* was unusual in that it included five words like *yellow*. In discussing these words he let slip the remark that he saw the *ow*. T apparently used visual imagery with auditory-

vocal-motor, the slow method of one unused to rhyming. Rg had five wrong in the first set; "ō sound caught me and I couldn't help myself." There was other evidence of auditory imagery: "Heard the words, sort of said them to myself, but with your intonation." For *hope* she got such words as *microscope*, *antelope*, *cantalope*, and for *low*, *window*, *elbow*, *meadow*, etc.; "There is a flash almost as if you saw them, all at once, but you *don't* see them." These words certainly come more from visual similarity of form than from rhyme in the strict sense; are dependent, that is, on sight rather than on sound.³⁰

The second part of V was designed to bring out visual-verbal, and consisted of finding as many words as possible in a minute that should have the same ending as a given word. The results follow.

TABLE B.

Ending	Ty	Y	S	B	By	R	H	Ev	T	E	A	Sc	Rg	Av.
-one	9	4	3	6	11+lw*	10	5	8	3	3	10	9	10	7.
-ough	8	6	4	3	7	8	7	5	7	3	6	7	4	5.77
-ose		7	5	5+3w	11	8+lw	9	11	7	7	8	8	2	7.3
-are	12+lw	6+3w	8	8	10	9+lw	11	11+lw	12	10			8	9.5
-ine		7+lw		7	15	12	9	16	10	9+lw	12		9	10.6
Av.	9.6	6	5	5.8	11	9.4	8.2	10.2	7.8	6.4	9	8	6.6	

* w = wrong.

First group: By, Ty, Ev, R.

Second group: A, Sc, H, T.

Third group: Rg, Y, E, B, S.

E's introspections show that improvement followed upon the adoption of a visual instead of a rhyming method. T, however, got longer lists with a rhyming method. Of the first group all used a mixed method, auditory-vocal-motor and visual; auditory marked for R, visual used by By and Ev only as test, visual method reported by Ty as most important. A, Sc, H, and T all used a visual method supplemented by articulatory. Of the third group B seems unable to use visual, uses articulatory rather than rhyming, even as a test; E found her ability to visualize interfered with by a rhyming habit; Y, using sound tested by visual—lack here as elsewhere, of vocal-motor—makes

³⁰ Matthews, Brander, *A Study of Versification*, p. 49. "Rime in English is an identity of the vowel sound in the last long foot and in all the sounds that follow it."

a slow and faulty record; S uses a rhyming method, interrupted by a slow visual. There is evidence of visual in some of Rg's words—at least of a method not rhyming. For *ough* she “couldn’t get away from the sound of ŭff”; and had long a sound for *ave*. In the case of *ose*, she “couldn’t seem to focus attention on either sound or form.”

The third part of V, in which words are to be given for a particular ending and arranged in groups according to sound, gives results that are extremely difficult to interpret. There seems to be a premium on a mixed method, where both visual and rhyming (auditory-vocal-motor) factors are present. We should expect to find By, Sc, and Ev in the lead, and do; R, H, A, and T following. Ty is unexpectedly in the last group; the trouble is a lack of flexibility somewhere, possibly a visual preoccupation, followed by a rhyming; she wants to rhyme. There seems to be a real difficulty in discrimination here with both Ty and E, both of whom are delicate and effective verse makers, with strong tendencies toward concrete visualizing. Rg also shows lack of flexibility here.

In the whole test, those not concerned in daily practice with words (A, T, B, R, Rg) do not come in the first five; but S, Y, and E who are concerned with words do come in the last five, S comparatively non-imaginal, Y and E very imaginal.

VI.³¹ The learning of words pronounced differently but spelled alike would seem to require auditory or vocal-motor imagery or both if any degree of success is to be attained. Associations and generalizations were, however, used successfully, and in the cases of Y and E at least, concrete visual representation of their meanings helped to hold the words in the right order. Y reports, for a perfect score, “When I went over the list I actually saw the things they stood for and I think that helped. Saw a dōve. Saw cliff and water for *dōve*. *Bow* was bow of boat. $\bar{A}(ye)$ and $(a)\bar{y}(e)$ never seem really to look alike [Letters in parentheses silent], the look of the thing they stand for is different, $\bar{A}(ye)$ is round and full, lighter in color,

³¹ Appendix.

(A) $\bar{y}(e)$ is sharp, dark, concentrated." E, six out of nine, "I tried to remember by forming a picture." T associated *wīnd*, *bāss* (Base Lake), *rōw*, accompanied by some visual-concrete imagery, and recalled *rōw* in consequence. Sc "Tried to remember pronunciation by remembering meaning." Auditory imagery appeared clearly with Y, T, E, and S. Y "remembered there were soft sounds at beginning, and hard and more disagreeable at end, heard *dōve* and *bōw* plainly." In the first set E had five out of nine correct, and two more vowels correct, said she remembered how they sounded. B was apparently vocal-motor, rather than auditory, and had no visual imagery. She thinks the use of her fingers as she listened gave her motor associations that kept the words in order. In the second test she reports, "For the most part I thought of them (the subjects held an unmarked list of words) before you pronounced them, and remembered in most cases from the fact that you did not give the pronunciation I had in mind." Apparently she remembered, therefore, from her own articulatory imagery, rather than from auditory impressions from my reading.

Subjects	1st test	2nd test	Method of learning
B	6	9	Motor, largely vocal-motor.
Y	5	9	Auditory and visual-concrete principally.
S	6	6	Auditory-vocal-motor.
E	5	6	Auditory? Visual, both concrete and verbal.
Ev	3	5	Says no auditory. Vocal-motor and articulatory?
Sc	6	7	Probably auditory-vocal-motor and meanings.
T	4	7	Auditory-vocal-motor. Some associations and deductions.

Very different methods seem to work successfully. The experiment gives clear introspections of method, rather than trustworthy objective results.

VII.³² Miss Fernald made use of reports on pictures for testing the presence of concrete visual imagery; she concludes that the absence of such imagery furnished rather satisfactory evidence of some degree of weakness in it. Reports on cards exposed, as Miss Fernald exposed hers, for ten seconds, led me to

³² Appendix.

think that the long exposure gave time for the development of a naming process that might obscure the visual elements; and that if I wished to discover how much could be retained without such help I should have to make a much shorter exposure. These results are, therefore, based on 2'', 10'' and some 4'' exposures, whose relative value will be discussed at a later point. If the visual types could be determined by proficiency in this experiment the subjects would be rated as follows, visuals of course leading. Subjects were not, however, urged to write exhaustive accounts of detail, as it was feared that they might be led into mechanical and unnatural methods of learning.

Subj.	Absolute No. of Details			% of Details			Method
	2''	4''	10''	2''	4''	10''	
Ty	14.3	(12.5)*	18.3	65	(58)	67	Visual (visual-motor). Some verbal.
Sc	12.6	14	17	61	64.5	61	Visual, and verbal in 10''.
Y	12		14.6	58		61	Visual (and motor).
A	11.5	14.5	10	56		46	Verbal and visual (visual-motor).
By	10.7		17	52		71	Visual. Some verbal.
Rg	10	(12.5)	14	50	(58)	50	Visual. Some verbal, esp. 10''.
H	9.7		12.5	47.5		47	Visual. Verbal in 10''. Motor.
S	9.7		10.3	47		39	Visual-motor. Verbal. Associations.
Ev	8.7		12	42.5		47	Visual. Verbal in 10''. Associations and relations.
R	8.7	12	13.8	42.5	51	58	Schematic (visual). Verbal. Motor.
E	8.7		14.3	42.5		66	Visual.
T	8.6	13.3	11.7	41	51	51	Visual. Motor.
B	7.6		12.7	37		47	Verbal (esp. 10'') Visual-motor. Meanings.

* Figures in parenthesis based on two records only.

When the method is considered, however, it is seen that though the highest places are taken by subjects who use a largely visual method, some of the lowest places, especially for 2'' exposure, are also held by visuals (E, T). On the other hand, it is noteworthy that those who make a marked advance, both absolutely and relatively, with an increased time included these same individuals. These per cent results for 10'' are apparently a pretty good indication of visualizing power, and are borne out very well by the previous tests except that R attained his results by

a very mixed method, and that, from the introspections, the visual T would be expected to rank higher.

Now as to the determination of these methods of learning and recalling.

In the examination of visual characters the first thing done was to study the color imagery reported. Subjects varied a good deal in this respect. Some are much preoccupied with color and with light and shade—H, By, Ty, Ev, E. Ty: "A night scene, dark blue sky. Stars, snow on ground and on post. Pleasant contrast in color in that lighted doorway—very green Christmas tree against reddish orange interior. In houses on right pleasant contrast, warm lights, kind of vermilion, in dark blue or green houses." Some remember the colors they see with great accuracy, as T; some see in recall more vivid colors than are in the card, as Sc and B; others fainter as Ev, who after delayed recall reports that when he sees cards again he finds colors brighter than he remembered them. Often colors are reported that are not there at all; H particularly, recalling a black and white photograph of a garden, saw "Hollyhocks of glowing colors, reds and pinks, bees humming in them, under hot sun," and R, also recalling a black and white print, reports "Sky a sort of yellowish blue." Rg pays a great deal of attention to color in her reports, though it is often wrong. Ty gets vivid colors; when they are wrong, as often happens, the brightnesses seem to be correct—the color values are right. Some seem to be confused by color and do not try to remember it,³³ colors are right but apparently floating, loose.³⁴ Some of the color confusion appears to rise from association; intensification of color and finding it where there is none, from a sort of getting into the picture—a process which seems to involve motor imagery. A makes many errors in colors, due to dependence on naming and association, and probably also to lack of good color imagery. With S color is

³³ R. "Colors mixed me up." "A lot of colors, reds and blues etc., didn't bother with it."

³⁴ S. (Japanese scene) "Confused picture of yellow and other colors rather unusual in buildings, can't name any color surely but yellow though—curving lines of bright yellow stand out distinctly."

merely a secondary consideration, and so probably a weak image. In general, those who have seemed highly visual in other ways are good at color. Sc is not so good at color as might be expected from the objective results;³⁵ B is rather better but reports "not much color in 2" exposures." It is difficult to know whether to class a tendency to intensify color and to see it where it has not been as an indication of good color memory or the reverse; it certainly indicates the presence of color imagery, and perhaps a weakness in holding visually presented factors grouped. T, who seems pretty purely visual, is perhaps the most accurate in her color reports; she is habituated to making fine color discriminations in scientific work. Grouped roughly as to color imagery: H, Ty, T, Ev; By, E, Y, Sc; Rg, B; R, A.

There is a great deal of variation, too, in the distinctness and accuracy of visual imagery. S affords as good an illustration as any of lack of distinctness or order in the image.

S. (10" exposures.) Street scene: "Got general picture when trying to write down, white and black dots (hats, shirts, etc.) dancing or floating around during reproduction."

Animated street scene: "Street empty."

Street fair: "Visual images danced around." "Child could go as well in one place as another."

There was, however, considerable difference with this subject between 2" and 10" exposures. For 2" times, she reports that she "saw pictures quite plainly when recalled, pretty well as a whole." The explanation for this I should find partly in a real lack in definiteness in visual images, an ability that could easily be overtaxed, and partly in the effect of the ever present associations in the 10" exposures for which there is no opportunity in the 2". The following example will bring out this last point as well as the others.

(10" exposure.) View of Washington apple picking scene. "Saw trees and people in general way—conscious of reds and yellows. Saw man and said to myself 'picking cherries,' thought of a cherry picking I had witnessed (vague visual image of

³⁵ Sc says he can match colors well but has difficulty in remembering the names. He probably neglects color names.

tree, but more a half motor or locality consciousness of being somewhere else—to the right—where I had told yesterday about this experience, locality not accurate). Then looked to see if they were cherries, saw that they were too large and said to myself 'tomatoes'...had a locality sense of apple picking in Oregon. Deliberately counted people, noted sizes and order. In recall: the general mass was visual—used eye motor. Saw diagram of trees and people—sometimes three, sometimes four."

At the other extreme of definiteness:

Y reports that she "sees pictures perfectly."³⁶

R reports that he can "call up and see as vividly as he wants to."

T. Japanese scene—"pine trees, conifers, mostly green. Trunks of two at entrance brown, sunlight striking them from above at right. Spot of brown on needles of left center tree. Couple of yellow green splotches on the green trees...."

Ev. (Mountain range. In sepia.) A mountain in the background. The side that slopes toward the left foreground slightly cut up by gullies. Toward the top the mountain is lighter, perhaps from bared rocks or snow, and this lighter part extends down in streaks, emphasizing the formation before spoken of. In the foreground several trees; in particular one to the left center, whose branches sweep toward the left as if the prevailing winds had been in that direction. At the right edge of the picture the branches of another tree—or trees—extend into the picture as if influenced by the same prevailing winds. A little back of these trees is some sort of a dark plot (right

³⁶ There is not in these recalls of picture postals any such "revival of personal attitude and emotional value" as Woodworth mentions as alone "enough to create a strong atmosphere of reality." (Woodworth, R. S., *A Revision of Imageless Thought*, p. 16) Y's introspections show very little or no feeling, the presence of which, under these conditions, usually involves the revival of a picture much more changed by associations than any of Y's. I have found a small number of observant people, outside my subjects, who feel sure that their recalls are as vivid as the original experience, though I suppose none of them would claim the presence of much if any content not noted—paid attention to—at the time of observation. The lack of such addition would not, however, prevent the recall's being as vivid as the original experience.

center) that I could not make out. (Direction—Write a description.)

By. (Glückliches Neujahr. 10'').) "Glückliches Neujahr" is printed in large black German type about an inch and a half from the bottom of the card on the right. Three musicians are standing before a stone house, in the snow, which has a bluish tinge. They are dressed in quaint but not antique costumes. The one on my left was playing a violin, the middle one with his back squarely presented, standing on one foot in a square patch of yellow light coming from the window of the house above them, plays a horn with a wide end. The one at the right plays a flute? or fife. There is a door with stone steps covered with snow, partly out of the picture on the left. The grayish surface of the house is streaked in an irregular pattern with white lines. On the right beyond the musicians is the corner of the house where there stands a post about three feet high. Foot prints go around this corner. In the background on the right is a house with reddish light windows and walls of greenish ? white, and partly obscured by it a church with a single square based steeple, also showing reddish light from the windows. The clothes of the men, the walls, and everything but the snow, are in varying shades of what seemed a mixture of green, purple and blue. (Subject was sure he would remember Christmas tree, but forgot it.)

H. (Glückliches Neujahr. 10'').) Three jovial little Germans playing the New Year in before the closed door of a little stone or stucco cottage. A light shines from a square window upon the snow, and falls in a bright yellow patch just where the middle fiddler is standing. The window itself is glowing orange with the light—the top of a little Christmas tree shows in it. The fiddlers' knees are bent—partly playing, partly excited, partly cold. A trodden path in the snow leads to the right around the corner of the house. A stone post stands there. Beyond to the right a wall, over which long lovely sprays of bare twigs (long pause) exist against and toward the sky, projecting upward and toward the right. There is another small stone building to the right. The words are in the lower right

hand corner, Glückliches Neujahr, fancy letter placed in careless 'artistic' effect. (Sees picture: Oh—had a feeling that it was a church. Just ordinary German script, too. Highly idealized the twigs, didn't I? I got a strong sense of life from the picture.)

Sc. (Glückliches Neujahr. 10''). Three musicians; violin, left, side view; horn, back view, end of horn showing at left; sort of flute at right, players left side turned. All dressed in dark clothes. House with arched doorway at left. (Drew it.) Four (should be six) -paned window at right of doorway, shut or open, window lighted, green tree inside. Foliage showing above house wall further toward right, had flat look. Beyond that a sort of street with windows lighted. Perhaps a little churchlike structure. Snow. Glückliches jahr?

tag

The difference between an idealized picture and a simply accurate one is shown by the two descriptions of Glückliches Neujahr by By and H, given above.³⁷

It seems impossible to separate visual-motor, and to some extent other motor, from visual imagery. When relative position, direction of curves, elevations, and so forth are learned, eye-motor would seem to be a factor, though a sort of right and left movement, perhaps of the hand, or a feeling of positionness in the whole body, are often present. A seems to depend very consciously upon eye and head motor for every thing of the sort. The following are quoted as typical introspections where there is special attention to line and position.

By. "Always get lines before color."

R. "Get relative position, right and left, by slight movements, noting in mind that it is right or left." Subject ordinarily used his hands freely in describing, to show me how things were.

Ev. "Sort of localization of memory, getting general light and dark of whole picture. As soon as remembered this got fairly definite form."

B. "Picture not well balanced." "Got balance of picture right and that helped in recalling."

³⁷ Page 39. Ty and Y illustrate this point further.

S. "Named something whose locality, at bottom, alone remains."

The feeling of localization that comes out in the introspection on the apple picking (S), and the feeling of being in the scene of a picture, the vivifying of it, seem to be, at least in part, dependent on motor imagery. H is *in* the garden (of a black and white print) where she finds colors, sun, and warmth; with respect to her view of mountains she "was as much there as anything." Clearly kinaesthetic and tactile appears the following: H (portrait of a lady) "felt the pearls heavy on her neck." Of those who appear to be most motor in this way A, R, H, and B had been diagnosed as eye-motor and motor in preceding tests. There was a tendency to draw, which seems motor, on the part of almost all. It was very marked with Ty, almost as much so with Sc, Ev, and B, even showing a little with S.

A good deal seems to be retained by means of what are described as feelings, attitudes, impressions.

S. Got a beautiful aesthetic impression.

H. The second effect was of artificiality and cheapness in the print. Felt pomposity in man on ladder. (Of a church interior) The effect is Baptist.

Ty. Impression of man with back to me was of fatness and roundness and jolliness. (Of another picture) Had a pleased feeling.

A series of recalls was taken one week later, to see (1) in what way the cards returned to consciousness; (2) how clearness, accuracy and fullness of detail in the delayed recall compared with that in the immediate recall, which is from something almost like an after image; and (3) in what form or forms this detail occurred.

Sc. When asked to recall last week's pictures, he gave them in almost exact order of presentation and said when asked how he recalled them that he *saw* them. When questioned he said, "Oh yes, I just saw the pictures." He indicated them, too, by what was more a description than a title: The little girl sitting on the rocks; The New Year's one with the three musicians.

R. (2'') Church interior. It came back first through a motion

he had made with his hands when he was explaining the line of the pew backs. The Runaway. "Horses came first, probably visual. Then things jumping up all of a sudden, heads, etc. Then the word 'horses.' Picture became clear and picked out details." Port Austin. "Girl on rock." "I probably got phrase first."

(4'') Futaara. "Saw gate very distinctly." Christmas Booths. "Lighted booths." "I probably got phrase first, or two together."

(10'') Italian Lady. "Saw face, picked out words and got details. Remember didn't like face very well."

Ty. (2'') "Remembered phrase 'Lincoln's Inn' before recalled the card. Then I recalled something unpleasant." (Later recalled Church Interior in this connection.) The Runaway came up in its composition and atmosphere.

(10'') Canongate came first, saw the card before got name for it.

E. Remembers for the most part as if she had drawn them and could look at them again. True of both immediate and delayed recall. Colors pretty distinct but not always sure it was the right color. "Recalled people buying Christmas toys at brownish booths with lots of light inside them. Visual first."

Rg. "They come back rather hazily as pictures before any names come." (Borne out by the way she names.) "Next is color tone of the whole, before individual figures seem to come."

In all but three cases of the eleven subjects tested on recall the cards seemed to come back first as pictures. With R and Ty, phrases used seemed to have occurred first for some of the cards; in one case R recalled by motor means; B does not know how hers come back. To Y, By, Ty, and A, the images of delayed recall seem firmer and clearer than those of immediate.

Y. All these pictures are infinitely clearer now than they were the first time. Writing out and checking up enforces details. I see them perfectly.

Ty. Can see some of these much plainer than the Japanese one (Nikko) I just had.

Ev. In general I see the pictures almost as clearly as I was able to see them a minute or two after picture was exposed.

Degrees of accuracy and fullness, and the character of the detail are shown in the following statements and introspections. Sc reports that he thinks of details now that have been in mind all the time, called up now perhaps in connection with the same things they came up with before. He thinks he was aware at first of two related details, a and b, a—color of trees, b—shape and probable kind; then became interested in expression of a, and when he had expressed it went on to c. In the delayed recall Ev thinks of points which he did not consider in the first recall, and which he is, therefore, sure of as really visual memories, that is, not aroused by a verbal memory of the other recall. When he sees the cards again he finds the colors brighter than he remembered them. A's recalls are good; he adds details, and though apparently first recall is not, delayed recall seems to be from a visual image. In immediate recall the process was "primarily one of naming. After the name came usually some vague and fragmentary visual imagery. Position came largely in head- and eye-motor terms." B has a visual image of the card in mind during recall. She thinks her visual images are built up quickly, more a checking up process than a remembered whole,—in which respect they probably resemble A's, and possibly R. S. Woodworth's.

Ty. Fröhliche Weihnachten is growing more comical.

Y. (Seeing card again after delayed recall). It is prettier in recall than the original.

Rg. When I see these pictures again they are very different from what I recall. For example, I read in backgrounds from other pictures.

Sc. (2'') Port Austin. Immediate recall: Lake fills most of left and distance. Strip of land going clear across, back at horizon. Not much sky. Right foreground, girl, white dress, on jutting rocks. Back of her toward background, wharf, sort of landing. Building to right, back of that woods, foliage, or something of the kind. Lake is still. Building white. Color of sky, lighter than lake. Seems to me had impression of hair ribbon. Second exposure: In memory lake was a good deal deeper blue. Didn't see printing at all.

One week later: Little girl in white, on rocks at right front of picture. Dark hair ribbon, feet dangling over rocks (verified in second exposure). Back of her, large white building among dark trees. To left of buildings a sort of wharf extending out into the lake that takes up most of the center and left of picture. Land behind the whole of lake. Narrow strip of sky. (From second exposure: lake rather light blue, not bright. Reflection below large white building makes a sort of light green patch on water. Trees, one at least, seem to be pines. Noted that rocks took up more of picture than I had thought.) While looking at picture first time looked for boat, because of lake. (Described "from the mental picture.")

Ev. (2'') Lincoln's Inn. Immediate recall: After a few minutes' conversation on something else subject remarked that he had completely lost the memory of the picture. "General dull colors (dull was what they were) came back, pretty much as a whole. . . . Nothing apparently started it, was trying to remember whether it contained animals, people, faces."

First description (April 29): Very dull subdued color as in a fog. City street, walls of some sort rising from edge. Looking down it, an arch across it. A large opening under the arch for the roadway and a smaller one for the sidewalk at the left. I think there was none for the other sidewalk. Arch flat on top and extending clear across. (Correct.)

No second exposure.

Delayed recall (May 6): A foggy scene, or night scene, in London. There was an arch across the road that ran back into the picture. A small archway over sidewalk at left. Some sort of walls on each side of street. I think there was some dark substance—probably foliage—appearing over the fences. Colors were dull grays and browns—with a slight grain as if made by crayon on toothed paper. (Introspection: Largely visual. Fact that had written something before had great effect in helping to organize—does not bring back particular words. 'London' was firmly impressed, but thinks not necessarily or purely as a word. Good sketch accompanying, of gate and its relation to street.)

A. (2'') Port Austin. Immediate recall (May 5): Water on

left, light blue in color, went to edge of picture on left. Straight back of water an irregular outline of trees. In foreground just to right of center was a young girl seated on rocks. Rocks dull slate color just like natural rocks.* Girl wore a white dress, short, just below knees, white stockings and shoes.* She was sitting slightly facing me but more towards the water. No hat, hair down her back, not in a braid, but gathered at the neck. The rocks extended for some distance past her and to the right foreground. In the background was a rather spread out two-story and attic white cottage. Ordinary peaked roof with a couple of dormer windows. Eight other windows. In front of cottage was a pier extending fairly far into the water. In the background was an irregular line of trees. (Said he had forgotten roof was red. The print in upper left was red, the roof was not.)

Delayed recall (May 12): Left foreground—light blue water, lake extending some distance back. Left background—irregular line of trees on skyline. Right foreground—clump of rocks rising very rapidly to the right. Seated on rocks at water's edge, looking into water but facing slightly towards subject, a young girl. Dressed in white miss's frock, short, white shoes and stockings.* Hair hanging down her back loosely* but bunched at nape of neck. No hat. Right background towards center—a two story and attic white house, rather large, partly hidden among trees. Several windows visible, six or eight. Seems to be red trimming about the upper part of the house,* two chimneys. V roof. In front of house a rather long pier, dark gray in color, extending into the water. The top of it is not very high above the water. In the background more trees. No boats visible on this water.

* Errors. It is perhaps noteworthy that B, A, and S, who report least concrete imagery in learning, and most unanalyzable content—S many "associations"—are most inaccurate in recall. Definite concrete imagery may be a factor in accuracy.

The other introspection, besides those on delayed recall of cards, were examined carefully for verbal imagery, for purposes of diagnosis. Results from the introspections on cards follow.

No verbal imagery reported at any stage: Y, T, E, Ty (Counts and pays a good deal of attention to print.)

Y. (2") Port Austin. The red of the printing appeared in the house roof. When asked if she named, in Nikko, where naming for identification would be likely to enter in, says no. In recall calls up card "edges and all." If while looking at picture shuts eyes, opens and corrects, gets better results.

T. In recall of Kittitas (10") got both men on ladders. After recall of Fröhliche Weihnachten (2") said on seeing card again, "The little boy is bigger in my picture." In 10", got a general impression, then went after details. Thinks no naming. In the second 2" exposure, knew it was 2" and didn't try to take in too much detail or wouldn't have got anything. Thinks no naming.

E. Several times while looking at picture talked about something else, which might be supposed to inhibit a naming process if it was articulatory.

Ty. (4") Fröhliche Weihnachten. The trees are scraggly, some kind of pine, and seven in number. Subject reports that she is attracted first by color brightness, then by anything that tempts her numerically, then by print if there is any. Says she doesn't think of names.

Verbal imagery reported for 10" exposures, little if any for 2" exposures: S, B, Sc, Ev, H.

S. (10") Photograph. As I looked I said, "She looks like Inez." May have said "hollyhocks" and "arbor" to myself but seeing it so much at the same time that I am not sure. As I started to write about things words would come into my mind. Subject thinks that vague words are indications that she was trying to remember. She says, "I got sort of picture of another garden with holly-hocks and was conscious of the name of the flower. Nikko. Read its name and said it to myself. Just saw the rest. Tried to find something I could "light on"—I suppose with a dim hope of naming and thus remembering, but gave myself up to confused impression of colored pavilions or something of the sort. Brighton. Saw things and said "aero-planes." Saw they were flags before said it—without naming. Then called them "flags" from sense of duty because had mis-called. Fröhliche Weihnachten. I remember I called child

"dear little angel." Don't think I named Santa Claus until trying to recall.

(2'') Port Austin. Read the print, just plain looked. Interior of Church. Counted the windows, didn't name anything. Lincoln's Inn. No verbal imagery. Runaway. Word "hunt" came in recall, possibly when looking at it.

B. (10'') Mountains. Method verbal. Used phrases rather than words. Used visual to check. Futaara. (Asked to get colors.) Remembered "blue roof," "pink tree," etc. Learned by words, visual recall. Christmas Booths. Much naming. "More anxious I am to remember definitely, the more I tend to name."

(2'') Port Austin. Didn't name anything. Didn't see much detail. (Drew pretty accurate diagram.) Interior of Church. Got picture from visual after-image; continuation of old process rather than new one set up, practically lengthens exposure. In 10'' exposure had time to depend on other things and so did not need or notice the after-image.

H. (10'') Thinks from experience of forgetting details that she was "going to remember" that "you must just passively soak it in, or you'll get the details separated."³⁸ She named occasionally for identification.

(2'') Detail much cut down, just look with no thought of words. With 10'' more apt to notice separate factors and to name a few things or colors.

Sc. (2'') Has tendency to sketch.

(4'') Lincoln's Inn. Named things to himself—"arches," "two," etc.

(10'') Nikko. (Given spontaneously as comment.) While learning card was trying to find out what the things were, to find names. If material had been familiar thinks never would have been conscious of naming process, would have perceived picture and got the names so close together that would not have been aware. Names, as a device, unimportant things "that you think

³⁸ A surprising number of cases occur where mental reservation was made to remember an important thing and it was forgotten. (R, By.)

you'll forget." Puts down not so much what he sees as what he *remembers*. By the time he has written a bit he has forgotten all sorts of things that he saw. But he does not seem to be relying very much either on verbal images.³⁹

In these cases it would appear that the increase in the time accounted for the presence of verbal imagery.

Noticeably verbal: A, R, By, Rg.

A. (2'') Process was principally one of naming; good deal of eye and head motor.

(2'') Lincoln's Inn. Sunset snow scene, looking into the end of a street. Street stopped with a high red brick wall with a gate in the center. Past the wall were the outlines of several brick buildings. To the right of the picture just to the right of the wall was a larger irregularly shaped building, noted for its large and frequent chimneys. The buildings towards the foreground were smaller. To the left of the end wall were a few low buildings hidden behind another wall like the end one. Side-walks on each side and at the end man standing on side walk near gate at end. Some small trees lining street. Street itself appeared white as if covered with snow. About usual width. List of words used in learning in so far as they could be recalled: wall, red, gate, house, hump, trees, street, snow, dark, low.

Recall: Street scene. Dusk. Snow on street. End closed by fairly high brick wall. Gate at center. Man standing near gate. Street lined at end and both sides by small trees. Beyond end

³⁹ There is a resemblance here to Woodworth's experience. "What I got was sometimes to be called an image and sometimes not; but in all cases, with a few doubtful exceptions, it consisted of facts previously noticed. When I say 'facts,' I do not mean verbal statements of facts, but a direct consciousness of some thing, quality, relation, action—of something which I had observed in the original experience. I did not get back experiences as concrete totals, but only facts which I had discriminated out of those totals. In the original experiences, those facts had had a concrete setting or background; but this setting was not recalled. The facts were recalled in isolation." (R. S. Woodworth. *A Revision of Imageless Thought*, p. 12.). It is possible that Woodworth does not enough consider the probability that he is of a particular—and that perhaps a not very common—type.

wall some rather imposing stone buildings. On right some rather large buildings hidden behind wall. Many chimneys and chimney-like structures. On left, continuation of end wall and behind it some more modest buildings. Street has curbs and walks at both sides and ends.

(4'') Wrote out lists of words used, got fewer than he expected.

(10'') Got more of general effect, actually reported fewer details.

R. (10'') Canongate. Made a note to call them Highlanders—name too long to use. Photograph. Named, visual to check.

(2'') Got geometrical plan first. Then filled in. Naming occurred in placing details.

(4'') Christmas booths. Got a chance to visualize it more. Futaara. Naming, nothing motor about it, association aroused in cortex. In recall, see my plan of the picture, don't see words.

(10'') More naming and more visual.

By. (2'') Interior of Church. Word 'vaulting' came into mind. If a thing may be one of two things, if identification enters in, naming takes place.⁴⁰ Nothing else he would call naming here. Lincoln's Inn. Named "gate," "Gothic," "snow."

(5'') Portrait of a Lady. Naming process.

Rg. (2'') Port Austin. On seeing picture tried to see it vividly enough to keep after picture in mind. Recollected as an entire picture, picking out one detail after another in writing of it but seen as a whole. Interior of Church. Remembers saying, "red printing in corner, gray pews." Otherwise seen as a picture while writing.

(4'') Fröhliche Weihnachten. Probably articulated the German words, and the little hills were seen separately. Lincoln's Inn. Said title to herself as saw. Apparently no other naming. Rest of picture stays easily as visual.

(10'') Try to burden my mind with more details now you are showing them longer, sort of bothers me; I go from point to

⁴⁰ Ev. (10'') Nikko. Named somewhat, rather for purposes of identification than for memory.

point in the picture, more a series of details than a single impression.

By and Rg are not so verbal as A and R. With R and Rg there seems to be more naming with the longer period.

The differences for the different times in methods of learning and recall come out in the introspections. In general two seconds were too brief for a clear impression, in several cases too brief to get significance (T, B, Ty, S). It was in this exposure that such errors were found as the red of print appearing in the roof of the house. The observer gets general lines or masses, and color effects and has a tendency to use after-image to lengthen time (B, A). In the majority of cases (8 out of 13) no naming was reported for the 2" times, although one subject (Ty) counted and read print in that interval. Of these eight, four report no naming for 10" exposures, the other four depend upon it somewhat, especially when the matter of identification comes up. Of the four (Y, Ty, T, E) who report no naming all are markedly visual types in the other experiments; of the four who name, two (Sc and H) are good visualizers, also good verbal types, and two (Ev and B) are weak visualizers, one (Ev) very verbal, and the other uncertain—a highly articulatory type when learning words, but apparently not especially a user of words when the material is concrete. In the cases where naming was reported for 2" exposures four (A, By, S, R) are verbal; Rg is neither especially verbal nor especially motor, is on the contrary, visual-concrete and auditory; S and By for 10" periods can not be sure whether they name or not, certainly they do not name freely or as a conscious method. It appears probable, moreover, that A, who reports most naming and most definitely, overrated at least the extent to which words were clearly formulated. There is clearly some tendency for verbal imagery to increase with lengthened exposure.

The relation of the 2", 4", and 10" periods is expressed by the group using verbal imagery as follows: A, opportunity to add words in 4" (in 10" he really got a more general or a more confused impression, the statements are more general and the count

goes down); R, 4" gave a chance to visualize it more, used scheme to save time, naming elements, 10" meant just more visual and more naming—no change in method; Rg, 4" stays easily as a visual impression, 10" gave more a series of details than a general or unified impression. Verbal seem to have been a poor method for Rg. The non-verbal group reports as follows:

Y. Method same for 2" as for 10", but with 10" had time to be conscious what I was doing, to think how I would write them down—I think it doesn't work very well.

T. Cannot grasp a picture in 2", succeeds much better in 4", loses in 10", probably from association.

H. Detail much cut down when have 2", just look with no thought of words; with 10" notice and name separate factors, really remember better when I don't get details separated but just passively soak them in. (H increases number of details considerably between 2 and 10 seconds, but per cent not at all.)

The one great difficulty for the visualizers, and for some at least of the others, in the 10" interval seems to be that time is given for many associations with other scenes and pictures, which results either in a new group-organization often involving idealization, or in confusion.⁴¹

The 4" period seems to give the best results as a whole. There is time to grasp the picture, especially for the slower visualizers; the more purely verbal do not seem to gain much by the longer time, if anything they lose, like A; and it does not give time enough for the unity of the impression to be broken up or for confusion or idealization to take place through association. An occasional visual-verbal like Ty may increase the number of accurate details in ten seconds, but so far as the reports go it is at the expense of a great many errors. There are certainly twice

⁴¹ H. (pp. 32, 37) Of one picture reports that she was "there," of another, "confused with the other Japanese picture." In one black and white print she gets color, sound and sunshine into garden scene.

S. (p. 33) who depends more than any of the other observers on associations and relations, is "reminded of another picture"; "saw another garden"; "thought of a cherry picking I had seen."

R. (p. 32) reports a blue sky in a sepia print; says he doesn't get into the scene to see and feel things except during the longer exposure periods.

as many errors in 10" as in 4" periods, and practically none in 2". Errors appear to be largely due to association by similarity, which takes time, and are much more common with visualizers, though there are individual differences. T (visual) and By (mixed), I should characterize as accurate types, perhaps inclined by habits of observation to keep entities separate.

Visual concrete imagery and the single impression,⁴² judged by the effect of the 2", 4", and 10" times, would seem to have the advantage over a verbal, analytical method. In the first place, the least visual, A and S make not only no improvement in the per cent of details learned, but show actual decreases of 10% and 8%. Rg and H, who though good visualizers use a somewhat verbal and quite analytical method on this material in the 10" periods, make no improvement; both report confusion in the longer time. Sc who also employs verbal imagery quite deliberately in the 10" period, though a good visualizer also makes no improvement from 2" to 10", although in the case of both Rg and Sc the data for 4" shows a decided improvement. Y, one of the best visualizers, reports that the 10" period gives her time to consider how she will write down her report, which she thinks is confusing; she makes an improvement of only 3%. Ty, also one of the best visualizers, with a strong tendency always to consider how she will express herself in words, though she increases the absolute number of details learned, makes a proportional gain of only 2%. By, E, T, and Ev, all visual, and all habitual users of visual imagery wherever possible, except Ev, who can use it and who makes the least improvement, made an average improvement of 14%, without Ev of 17.5%. These four, so far as the introspections show, used no verbal imagery in learning, and recalled from a visual image. B and R are the exceptions, with per cents of improvement of 10 and 15.5. B, though she does not seem very visual, nevertheless recalls from a con-

⁴² B reports that she "learned details (10") verbally, visual didn't stick, the more anxious to remember definitely the more verbal." But thinks she recalls from a visual image "built up quickly, more a checking process than a remembered whole." These visual images, built up later from a verbal and unanalyzable learning process, a "noting" of details, are different from the "single impressions," the "soaked in" details of the visual learner.

structed visual image to a considerable extent, and supplements visual by motor and by "meaning" as well as by words. R uses a mixed and very methodical visual-motor-verbal method and improves steadily, 2" 42.5% of details, 4" 51%, 10" 58%. T, Sc, and Rg make their improvement, moreover, in the 4" interval. Unfortunately there is no 4" record for Ty, By, Y, and E. It would appear from this that a 10" time, in addition to allowing the formation of confusing associations, allows for a use, with some subjects at least, of verbal imagery and analysis which do not aid in the learning; the purely visual unity is broken up and no other has time to form. A visual method, if it is not confused with others, makes for improvement in this interval, or probably in the 4" period. The verbal type using a verbal method makes no improvement and may even fall back; the visual type using a verbal method does improve markedly; the mixed type using a mixed method also improves.

When we come to the consideration of the percent of details⁴³ remembered, the absolute standing in the whole experiment, what seem to me to be very interesting correlations between success and method appear. The least visual, A and S, get the smallest average number of details and the smallest per cents; they also get "a general effect," blurred, for 10"; both of these subjects have many errors. Sc, Ty, and Y, excellent visualizers, with a strong tendency to use verbal in long times, make very high records and make them immediately, in 2" to 4" exposures. T, visual, though not making an especially high record, makes it by the end of the 4" period, improving 10% between 2" and 4". E and By, excellent visualizers, E very slow, make their high records by the end of the 10" period, and unfortunately have no 4" records. Ev, H, Rg, not so efficiently visual as the others, make their good records immediately—all of them, like Sc, Ty, Y, tend to use verbal, especially for the 10" period. R and B make good records by the end of ten seconds, R by a mixed visual, verbal, and schematic (motor?) method, B by a mixed method involving some visual, a good deal of motor, verbal, and "meanings." On the whole, the more purely visual method seems to give a greater

⁴³ See Table, p. 31.

number of details in a short time, to be quicker and relatively more effective than any other. Visual is also quicker where not so relatively effective. A good mixed method, like R's, if methodically handled, is effective. A fragmentary visual picture is not integrated by S's associations and comments, nor by A's vague 'naming.' Association is slow, and confusing within these time limits. Motor is slow—R and B and possibly T. Verbal, probably because it involves analysis into details, is slow and confusing.

The test leaves the subjects in three or four groups as to visual imagery: 1. Ty, Y, By, Sc, E; 2. T, Rg, R; 3. H, Ev, B; 4. A, S. Of these, R, B and H are motor, probably also Y and T; Ev, A, S, Sc, R, the most verbal, though Ty, Y, and By use verbal imagery occasionally. T, E, and A appear to be the least flexible in type.

Correlation between 10" results, and visual type as previously shown.

Type	Subject By.	Per cent of details 70—80
Highly visual	Y	60—70
	E	60—70
	Ty	60—70
	Sc	60—70
Good visual ability	T	50—60
	Rg	50—60
	R	50—60
	H	40—50
	Ev	40—50
Weak visual	B	40—50
	A	40—50
	S	30—40

SUMMARY.

It seems evident that the imagery used varies greatly from individual to individual, and from task to task for each individual. Yet the results show a pretty steady and habitual use of imagery on the part of the individual subjects, an imaginal type, or type-group which can be fairly clearly determined. It is not, perhaps,

possible to classify people into a small number of fairly definite groups; but it is possible to become pretty definitely acquainted with the imaginal habits and capacities of any individual, and to describe him as more or less verbal, more or less visual, flexible, or many-habited or capacited, inflexible, or largely bound to one imaginal form. It seems probable, too, that he may be described as more or less imaginal; that is, he may have more or less mental content which, if it is imagery at all, or imagery as ordinarily conceived, is so complicated or syncopated or vestigial or otherwise unanalyzable that the subject can not lay a finger on it.

There is a great deal of imagery other than verbal, accompanying or even displacing verbal when verbal imagery seems called for by the nature of the material. Verbal imagery, moreover, seems to be of a very fragmentary character in most instances where it does occur. The relation of the idea or stimulus, verbal or other, to word is so automatized that in most cases no image of the word supervenes. Judging from the introspections, thought often takes place in concrete imagery,—which may be, and in fact usually is, except when difficulties of some sort arise, of a very syncopated, or possibly liminal character. In fact, thought apparently takes place clearly and in high forms, without the appearance of anything that can be said with certainty by the subject to be imaginal at all.

The free word-association test which follows was originally intended to settle, if possible, a number of questions raised in these diagnosis tests. When verbal imagery and reactions were undoubtedly stimulated by the conditions of the experiment, would visual or other concrete imagery function, would the concrete imagery precede the reaction word or direct its choice? Particularly, would a relation appear between this functioning imagery if it occurred, and the predominantly imaginal or non-verbal types? Then, too, if verbal imagery occurred normally before the response it would certainly come out in introspections here. Lastly, if meanings have a tendency to occur in imageless or unanalyzable forms it seemed probable that they would here, especially if rapidity of thought, and attention directed to other

ends are factors in such occurrence. That is, this experiment was undertaken in the first instance for the sake of the resulting introspections, which would have the advantage of covering an extremely brief interval of time, when the attention was very definitely focused upon a task, yet upon a task that left considerable freedom to the subject to go his own gait.

CHAPTER III.

THE FREE WORD ASSOCIATION TEST.⁴⁴

The free word association test, undertaken for the purposes stated at the end of the preceding chapter, has offered unforeseen opportunities for investigation of the function of words.

TIMES.

The first attempt to organize this material was an analysis of the reaction times. The times are given in sigma.

Subject	Reaction times. ⁴⁵						
	Total no. timed reac.	Av. time	Under 900	900- 1000	700- 1400	1000- 2000	Over 2000
S	112	1182	33%	12.5%	77.7%	50%	4.5%
Y	108	1205	31.4	18.5	69.4	42.6	7.4
R	107	1462	15	8.4	48	62.6	14
By	97	1502	2	6.2	45	80.4	11.3
H	110	1558	10.9	10.9	48	56.3	21.8
T	104	1564	13.4	2.9	51	62.5	21.1
A	106	1589	4.7	11.3	49	68	16
Ev	103	1868	.97	1.9	38.8	75.7	21.39
B	105	2265	5.7	5.7	30	55.2	33.3
E	94	3356	3.2	0	9.5	20.2	76.5

Of the two very quick reactors, Y and S, S had previously shown herself a verbal type and dependent largely upon associations and comparatively imageless relationships for learning; Y up to this point had been predominantly visual, and in this test has visual-concrete imagery accompanying or preceding about 56% of the reactions, the visual imagery appearing to be very intimately connected with verbal. Unfortunately, neither of these subjects was able to continue in the later tests. Of the three

⁴⁴ See description of it in Chapter I and in Appendix.

⁴⁵ The total average of these times, omitting the somewhat untrustworthy record of E, is 1577 sigma, with E's average 1755. The total average of thirty subjects in Crane's work (Association Reaction and Reaction Time) is 1434. The increased time in this experiment may be due simply to the fact that there were fewer subjects; it may be due in part to the different character of the words in the list; or the greater average age, 27.7 as compared with 24.7, may have something to do with it.

slowest reactors, Ev and B have seemed quite verbal, though both have a great deal of comparatively non-imaginal thought content; E is predominantly, I should say abnormally, given to concrete imagery and is extremely slow in the use of words, though by inclination a writer. The investigator feels assured in her previous judgment that Ev, E, and B are essentially slow reactors; these times correspond not only with previous time records but with the general speech habits of the three. R, By, and H, whose times are shorter than the average, are highly verbal, with plenty of possibility of concrete imagery, mainly visual, with R motor. Of T and A, whose times are about average, T is rather visual and non-verbal, A verbal and motor—comparatively faded or vestigial imagery.

No clear correlations appear between these times and the type-groups as previously determined, though verbal predispositions seem to have an advantage, and predominantly concrete-imaginal a disadvantage. The times are, however, clearly related to the sort of imagery used in this test, and are valuable for the indirect light they throw upon some of the questions raised. In order to see if the presence of imagery affected the times, and if so, if there proved to be any clear difference between individuals in that regard, a comparison of the times for automatic verbal reactions and reactions clearly accompanied by imagery was undertaken. Twenty-five times chosen from different days, for reactions as clearly verbal and automatic as could be found, were compared with an equal number, or as near it as the record of the subject permitted, of reactions accompanied by imagery, with the preference given to cases when imagery clearly preceded. With E it was possible only to take the reactions that appeared, on the face of them,—through comparison with other records, etc.—to be most verbal; twenty reactions were finally chosen. Y's record provided only fourteen clearly verbal reactions. On the other hand, with Ev (7), A (10), S (8) and T (4) it was difficult to get any number of image-accompanied words for comparison; T has so few as to invalidate the result, though the four used are clear cut and trustworthy instances. The absolute differences

in sigma are shown below, together with the per cents resulting from a relation of those differences to the verbal reaction times.

Subject	Verbal Reac. Times	Imaginal Reac. Times	Difference in Sigma	Percent ⁴⁶ of Delay	Type as Previously Retermined
S	889	1101	212	24	Unanalyzable, verbal.
Y	949	990	41	4	Very visual.
H	1001	1451	450	45	Visual, other concrete. and verbal.
R	1102	1407	302	27	Visual, other concrete, and verbal.
A	1129	1552	432	37	Visual-motor and verbal.
B	1222	1979	757	62	Motor, and other con- crete, verbal.
Ev	1249	1639	319	25	Unanalyzable. Verbal.
By	1263	1686	423	33.5	Visual and verbal.
T	1426	2038	612	43	Visual
E	2088	2975	887	42	Concrete imagery engrossing.

The per cents seem on the whole to give a truer basis for grouping according to the amount of delay. Y shows very little lengthening; meanings of the concrete sort seem to be habitual with her and her quick times would seem to indicate a very close association with speech (words). The next four, with a range from S, 24% delay, to By, 33.5%, are the four most clearly and highly verbal of the subjects. S and Ev provide very few usable examples of concrete imagery and neither appears to employ very much in reading. R and By are much more given to concrete imagery, but By, at any rate, does not use much in the reading of prose, though trained to use it for poetry. A, 37%, seems to have very little concrete imagery and to be quite verbal. These five are considerably delayed by the appearance of imagery but do not dwell upon it to the extent that the visually preoccupied E and H do (42% and 45% of delay), or T in the rare cases where it occurs. B with 62% of delay probably, like E,

⁴⁶ Crane, *Association Reaction and Reaction Time*, pp. 27-8. "The results of our experiments, while they cannot be definitely tabulated, indicate that as a general rule the coming, with the appearance of the stimulus, of a visual image tends to retard the reaction.

There are two general classes of visual imagery. There is a simple imagery, where nothing appears in the picture save the isolated image, generally of the object representing the stimulus word. There is a complex imagery, in which the picture represents a complete situation. In either case the natural result is retardation of reaction time." (p. 27)

T, and H, does not pass readily to verbal expression under any condition, and seems like them to be interested in her concrete imagery.⁴⁷

THE VERBAL ELEMENT

The verbal element was then analyzed, on the basis of both the reaction words and the introspections. The following factors were classed as verbal: repetition or pronouncing of stimulus words, perseveration of words, verbal form of stimulus word controlling or influencing form of reaction word, a definite literary context or phrase relationship, synonyms (not so surely determined, dependent on introspection), and other very close verbal associations, of class or category, drab—color; tapir—giraffe, turf—jockey. These last are especially likely to figure in other counts, because they are most likely to be accompanied by concrete imagery, and in some cases are even preceded by it.

Subjects	Time av.	Gen'l Verbal	No. verb. phrases
T	1564	90%	15
By	1502	88	70
A	1589	88	59
S	1182	84	46
Ev	1868	82	23
B	2265	84	60
H	1558	82	63
R	1462	74	46
Y	1205	65	14
E	3356	39	14

These results would seem to indicate that Y and E are the least verbal in tendency, By, H, B, A, and possibly S, are most so. I have omitted T from this group because of the extremely small group of combinations that can be rated as verbal phrases—she appears to be much more closely related to E and Y, and previous experience bears this out. She is neither a ready talker nor a practiced writer. There is a great deal of doubt in my mind as to whether the more automatic verbal reactions, due to influence of stimulus word form, should be interpreted as indications of a truly verbal mental habit. They are not inconsistent with it, but it appears probable that the automatic verbal re-

⁴⁷ Y's imagery, to use Crane's terminology, may be described as 'simple,' E's as 'complex.'

sponse may be present where there is not an habitual use of word images in the thinking process. In making diagnosis it might be well to distinguish as far as possible between automatic verbal response, and internal verbal, or use of verbal images. The position of S would, for example, be considerably affected; for stimulus-word form, both through appearance and articulation, influenced a large per cent of her reactions.

The lack of correspondence between Y's quick time and her very imaginal results points, together with some of the results from Ev, to a difference between verbal thinking and the close relationship between concrete images and words which consists in a visual-concrete form of *meanings*, 'simple' imagery. Meanings for Ev are likely to be present in the form of other words or in forms for him imaginally non-analyzable. By, who had the highest record in previous verbal tests, has, if the number of phrases is taken into consideration, the highest record here. E and Y, who have previously shown most visual-concrete imagery, show least verbal tendency here; that is, words do not call up other words directly. Both talk a good deal at times, but very hesitatingly when thinking. H is verbal in previous verbal tests, and has a high record here. A, showing little concrete imagery in other tests, has a very high verbal record here. At the two extremes there seems to be a considerable amount of correlation between these results and the others.

The high record in definite literary context of S and H should be an indication of a high degree of verbal memory. The presence of literary vocabulary and phrase emphasizes perhaps nothing more than the literary background and wide reading of S, H, R, and E. The absence of a high record in the cases of Y and Ev seems to need some explanation; both would be expected to rank high. Y, however, in previous tests has shown very little preoccupation with words as such, and a poor verbal memory. Ev has shown a preoccupation with significance rather than with the words themselves. A tendency to give-synonyms accompanied, at least, by consciousness of meaning, comes out with Y and Ev, and may account in part for the low verbal

record, doing away with the more automatic response. Logical relations and predicative reactions appear very little in this test where a premium is placed on the more automatic verbal response—on the first quick reaction. R, A, By, and B show most evidence of this.

PARTS OF SPEECH.

An analysis of stimulus and reaction words as to occurrence and relation of parts of speech bears out Crane's conclusion⁴⁸ that verb and adjective as well as noun stimuli give a marked dominance of noun responses. Out of a total of 458 stimulus words interpreted as nouns 386, or 84%, brought noun responses. Out of 161 stimulus words interpreted as verbs 88, or 54%, brought noun responses. Out of 383 interpreted as adjectives (such combinations as grate—fire, wind—storm, maple—sugar, were considered noun to noun reactions) 286, or nearly 75%, brought noun responses. It is significant, however, that with the records of two of the subjects removed the above per cents become 84, 62, and 88. The per cents for these two persons, Ev and Y, are 83.5% nouns to nouns; 25% nouns to verbs as compared with 72% verbs to verbs; 17.8% nouns to adjectives as compared to 82% adjectives to adjectives. These two make respectively 43 and 38 noun to noun responses, 8 and 15 verb to verb, and 28 and 32 adjective to adjective. A great deal of this is to be accounted for by the tendency referred to above to give in response synonyms, or words of similar or contrasting meanings.

For example:

Y. Severe—hard, broadens—narrows, scarlet—red, animated—quick, comely—pretty, jeopardy—danger, low—high.

Ev. Severe—hard, broadens—widens, scarlet—red (six of the other eight give scarlet—letter), comely—beautiful, jeopardy—danger, low—high, animated—lively.

Compare with these the following typical records:

R. Severe—cold, broadens—mind, scarlet—letter, comely—girl, jeopardy—life, low—bridge, animated—life.

B. Severe—teacher, broadens—me, scarlet—letter, comely—

⁴⁸ Crane, *Association Reaction and Reaction Time*, p. 8.

maiden, jeopardy—Hair-Breadth-Harry, low—sweet, animated—cow.

Only one of the other subjects (T) approached the records of Y and Ev and much of her record can be explained by a tendency to reply with a word suggested by the visual form of the stimulus word (comely—homely, low—blow, jeopardy—leopard, animated—animal, inculcate—calculate, distribute—disturb), though there is no doubt also some tendency to keep responses in the same class (blue—green, scarlet—red).

It will be seen from the table below that 764 out of a total of 1041 responses were nouns. The noun being the simplest and probably the most thoroughly automatized part of speech, its predominance in the responses is not hard to understand. But the distinction that held above is quite as noticeable here; the total noun reactions for Ev and Y are 46 and 56, for T 65; for the others 80 to 91. Here, as elsewhere, Ev and Y show a less automatized word to word relation, Y apparently making the connection through concrete-imaginal forms of meanings, Ev through meanings of a comparatively unanalyzable sort.

Parts of Speech in the Reactions.

Subject	Total number reactions used	Noun to noun	Adj. to noun	Verb to noun	Total noun reactions	Adj. to adj.	Verb to verb	Noun to verb	Verb stim.	Verb reac.
Y	102	43	6	7	56	28	8	0	16	8
Ev	108	38	7	1	46	32	15	8	16	23
H	108	41	40	10	91	2	1	1	14	5
R	109	35	33	12	80	5	3	6	19	12
A	106	35	37	12	85	3	1	4	17	6
T	97	34	24	7	65	7	7	3	16	12
S	107	41	36	8	86	6	3	0	12	6
B	105	41	35	12	88	4	1	2	16	5
By	110	38	39	6	84	0	0	3	18	5
E	89	41	28	13	83	0	0	0	16	0
Total	1041	386	286	88	764	87	39	27	161	82

CONCRETE IMAGERY.

A great deal of concrete imagery was present in mind for some of the reactors during the time between the appearance of the stimulus words and that of the reactions, notably for E, Y, H, and B. It was notably absent with Ev, T, and A. In general, it may be said that a high degree of concrete imagery does not accompany a highly verbal record, though the converse does not appear to be quite so true. The common concrete imagery was, as would be expected, visual. R reported a good deal of motor, and B a little. The especially significant point here was the fact that in many cases the presence of visual or other concrete imagery undoubtedly preceded any verbal image or response.⁴⁹ The directions for introspections in this test laid especial emphasis on a strictly chronological and orderly account of the mental content.

Subject	No. of react.	Presence of Concrete Imagery.					Tot.	% of react.
		Vis. prec.	Vis. accom.	Vis. fol.	Tot.	Other concrete		
Y	107	34	11	1	46	14	60	56
S	112	0	6	10	16	—	16	14
R	113	2	9	1	12	15	25*	22
A	110	—	3	—	3	5	8	7
B	112	8	6	2	16	1	17	15
T	111	4	2	1	7	—	7	6.3
H	113	1	24	7	32	9	41	36
Ev	113	4	2	—	6	—	6	5.3
B	110	6	3	19	28	7	34*	31
E	96	50	40	1	91	11	93*	97

* Some overlapping.

E, who reports 50 preceding, was somewhat confused and is therefore not entirely reliable; but Y, By, B, and R give very clear reports, and Ev and T appear to have the same experience. In a considerable number of cases the imagery has to do directly with the reaction word. These subjects are certainly capable of employing other imagery than verbal under circumstances most likely to bring out verbal: the task called for words, and the whole situation favors a verbal response.

The following reactions illustrate the occurrence of concrete

⁴⁹ Compare Crane, *Association Reaction and Reaction Time*, pp. 27-29.

imagery connected with the reaction word and preceding it.⁵⁰ The times are compared with the average for all reactions where imagery occurs.

Y. (990)			
chill	snow	1375	Felt baffled, then a fleeting picture of a winter night brought the word.
Hall	corridor	759	A fleeting picture of the hall in North, then "corridor."
chattered	noise	1295	Picture of apple tree full of birds. Then big table at house.
enjoyed	picnic	1411	Had C. in mind so word brought picnic of last night up river.
lawns	garden	761	Glimpse of green trees, then flash of Vassar Circle.
By. mirror	glass		Visual image of mirrors, then a substance—"glass."
omnibuses	London		Visual preceding of street with busses, named "London."
streaming	line		Strong inhibition, image of banner.
isobar	map		Tried combinations of "therm." Vague visual image of isothermal map.
B. (1979)			
mirrors	light	1609	Faint ray of light reflected from mirror, had in Physics this A. M.
bell	door	2088	Door in mind some time before able to get word.
vagrant	tramp	6477	Tried to think of word in psychiatry. Visual of tramp but set for other word.
chattered	squirrel	2059	Auditory image, then word, then visual image.
R. (1407)			
quince	lemon	769	Saw succession of fruits passing. Saw before saying.
host	friend	1342	Saw host and party. Said "friend" to say something. Could have said <i>food</i> or <i>men</i> .
Ev. (1639)			
carrot	tomato	1827	Groping for some other form of vegetable. Tendency to color image.
T. (2088)			
dusky	dandy	1463	Creole gentleman—checked trousers, yellow tie, straw hat.
E. (2975)			
florid	carnation		Saw carnations, laurel colored and white.

⁵⁰ Crane, Association Reaction and Reaction Time, p. 27.

"No. 2. Ear-Lobe, 4.764(2.688)

'Image of ear comes almost at once. Took some time to pick out what was going to say.'

No. 3. Activity-Mental, 1.667(1.030)

'Image of a student at a student's table. When I see those images the word don't come.'

critical (understood crystal)	crystal hang- ing things	4442	Crystal candelabra, lighted room.
Orpheus severe	harp Miss McC	1643 1463	Saw Orpheus with his harp. Complete portrait in gray dress of Miss McC.
dive	poise	4219	Tense girl, poised for dive from board.

In a number of cases the stimulus word seems to excite both verbal and concrete imagery; often when there is apparently a quite automatic phrase reaction, the concrete imagery, to the subject's observation, appears not only to occur as soon as the reaction word but to precede it. This tendency would seem to indicate the habitual connection of concrete imagery with words. The verbal reaction average is given for comparison.

Y. (949)			
Orpheus	Eurydice	1285	Visual of youth in Greek costume, then a girl,—then word.
R. (1102)			
fly	paper	857	Saw flies on paper before saying.
humble	very		Thought of Uriah Heep. <i>Was</i> Heep but "very" came out.
grate	teeth	1716	Thought of fire. Grating teeth (motor).
E. (2088)			
rippling	brook	2664	Saw brook, foaming in woods. Sure image came first.
wind	trees	2390	Sound of in big pine woods. Sight of trees then word.
scarlet	leaf	1778	Maze of autumn trees by V. C. Lake. Leaves in lake.
Ev. (1249)			
Orpheus	Eurydice	1642	Couldn't tell if other person or word.
brook	trout	1815	Saw brook, then fish. Then got word combination.
courtesy	bow	1969	Confused image of minuet in colonial costume.

In the following case there is apparently excitation of imagery by the partially excited word.

E.			
carrot	parrot	771	Big green and red parrot laughing. Thinks it came first, at least came with "parrot."

What seems to be the presence of meanings in concrete form occurs for several of the subjects.⁵¹

Y.			
96 assimilate	gather	2641	A feeling of tension, of wondering why word didn't come. Then sense of something like lines getting together— then "gather."

⁵¹ See V of Preliminary Group. Chap. II.

102 distribute	gather	914	A sense of scattering out. The minute I tried to remember it became a series of lines from central point—but I don't think the lines were there at first. "Gather" came quickly as if tension had been released.
sumptuous	rich	1328	Visual of shining colored fabric.
dusky	dark	1455	(Visual) Something opaque, soft, dark.
majestic	good	973	Vague picture of fairy king in robes.
H.			
jeopardy	Jepthah	1994	Always have thought of him with daughter in jeopardy.
severe	teacher	2118	Traditional teacher, my ninth grade one.
E.			
severe	Miss Mc C—	1463	Complete portrait in gray dress.
courtsy	man	1367	Elderly man in Louis XIV clothes taking off his hat.
eighty	cap	4008	Old lady in gray silk with lace cap.
B.			
severe	teacher	1447	Followed by indistinct vision of woman, tall hard jawed, with spectacles.
serene	day	4559	Day first word. Had idea of girl's face, not visual.

The following reactions illustrate rivalry of concrete images, another indication of habitually concrete-imaginal mental content.

Y.			
maple	willow	1036	Mixed idea of sugar and trees, both visually represented. Tree displaced sugar, then reaction.
dive	hole	1100	Associated dive with vagrant-robber brushed aside by paddle-canoe with picture of river with green banks. Same river.

VERBAL IMAGERY.

It may, on the other hand, indicate a verbal habit of mind when, as with Ev, By, and B, a verbal association will often break in and overcome a visual or other concrete image.

Ev.			
lake	river	1216	"The Lake" Winnepesaukee, "River" broke in.
chink	Chinaman	1372	Accompanied by consciousness that it was wrong. The chink of money was in mind.
B.			
chink	Chinaman	2277	Visual of chink in wall. Verbal came up and inhibited visual.
chill	fever	1369	Inhibition due to several things coming at once. <i>Felt</i> cold, said "fever."
By			
medium	hard	1435	Visual image of a steak.
low	bridge		Thought first of tide, but said "bridge" while <i>saw</i> tide.
bliss	Perry	1591	Vague idea of a state of being. Name came before could get word for it.

Verbal rivalry seems quite certainly to be an indication of a verbal habit.

R.			
courtsy	drop	2040	"Girl" came to mind first but "drop" got ahead.
also	ran	1538	Wanted to say "conjunction" but phrase came.
jeopardy	life	1139	Wanted to say "leopard."
Y.			
frog	oyster	856	Panic. Vague picture of marsh. Thought "fish" said "oyster."
due	money	898	"Dues" came half way up, then "money" quickly.
dyes	yellow	1066	Started to say "red" but "yellow" seemed to overtake it and get ahead.
H.			
chill	day	1552	Thought "November" (poetical association), but "day" came out.
quince	jelly	869	"Sauce," "blossom," "jelly" came most convincingly.
punch	bowl	1090	Thought "Judy," said "bowl."
piping	hot	1101	Thought of "Pippa" first. Couldn't resist "hot."
T.			
Orpheus	theatre	1596	"Muse" came vaguely.
medium	salt	2124	Thought "media" but it did not come distinctly.
S.			
maple	tree	1063	Pronounced maple. Impetus to say "bough"—not strong enough.
A.			
medium	price	1414	Was trying to think of "spiritualism."
enjoyed	time	1010	"Party" trying to emerge, but "time" beat it.
B.			
reading	book	1420	"Book" was not the word in mind, but it did not come up enough to be recognized.
Lake	Constantine	1813	"George" was in mind but would not come.
Ev.			
broadens	widens	1304	Hesitated. Words like "lengthen" threatened to come.
braes	banks	1671	Response delayed by struggle between beginning and finishing line.
bugle	bungle	1979	Read first syllable with short u. "Bungle" and "Burge" contending.
By.			
hum	bee	1323	"Bee" from sound of "hum." Then "Vergil." Said "bee" with "Vergil" in mind

More automatic reactions tend to come for H, T, S, A, R, Ev, By; less automatic for Y and B.

Verbal meanings seem sometimes to occur.

H.			
maple	tree	941	"Maple" means a "tree."
gem	biscuit	1521	A "gem" is a "biscuit."

A sort of judging or logical influence is perhaps visible in the following, and seems to me to indicate a verbal tendency.

A			
broadens	roads	4777	What do they broaden? Roads.
remember	what	1222	Struck as a question. Wondered what was supposed to remember.

R			
remember	what	1372	Remember! What? Feeling as if had forgotten something.
broadens	mind	1362	Looked for thing broadens might affect.
chattered	monkey	1548	Thought of what chattered.
By			
conterminous	lines	1991	Finally got word by deciding what stimulus word meant.

An attributive or predicative reaction quite certainly indicates a tendency to verbal thought on the part of By, A, and R.

A.			
knifeblades	dull	1618	"Knifeblade is dull." Attributive.
lawns	mowed	918	"Lawn is mowed."

A great many reversed verbal associations (not like Crane's "backward running," milk, bread and) occurred, especially in the records of B and R. S has a number that are purely visual-verbal. In order to see if the reversal was accompanied by a lengthened time, averages of the reversed and of five or six as nearly unimpeachable verbal and similar reactions as possible were compared; a comparison was also made with the general verbal time average. This procedure showed a considerable lengthening of the time (108 to 378 sigma over the special averages, to 604 over the general verbal average) for A, Ev, H, By, R, and especially for B. It is perhaps noteworthy that the subjects who have most of these reactions are all among those whose time is lengthened; that A, H, B, and R, all in this group, have the clearest motor tendencies; and that B and R who are most motor show the greatest delay. Practically the same, or somewhat (greatest difference 78 sigma) shorter times, are shown by the visual-verbal S and by the visuals Y and T. E has a very much shorter time average for these verbal reversals (723 sigma), which I take to be an indication that these particular reactions are really and

merely verbal. It seems possible that the auditory-vocal-motor types are most confused by such reactions and most liable to them.

Illustrations of reversed associations.

H.	Special verb. av. 1357.	General verb. av. 1001.
low	swing	2175 ("Sweet and low" in mind vaguely.)
S.	Special verb. av. 885.	General verb. av. 889.
clock	o'clock	885
low	bellow	877
chattered	teeth	871
A.	Special verb. av. 1124.	General verb. av. 1129.
extract	Pond's	1098
tide	high	1135
B.	Special verb. av. 1112.	General verb. av. 1222.
low	sweet	1500
eggs	butter	1438 (Visual of flower "butter and eggs.")
By.	Special verb. av. 1118.	General verb. av. 1263.
Hall	A. G.	2263
jeopardy	put	1123
dyes	diamond	1738 (Strong inhibition.)
R.	Special verb. av. 1120.	General verb. av. 1102.
courtesy	drop	2040 ("Girl" came to mind first.)
lawns	mow	1169
culture	German	1239
T.	Special verb. av. 1216.	General verb. av. 1426.
fly	swat	1268

Perseverance of word forms through several reactions occurs in a number of cases: Y, 12; S, A, By, and B, 7; R, T, and Ev. 5; and E certainly 4 (9 cases of repetition). In the case of Y it seems to be the indication of fatigue, the inability to check pure automatic reaction. For example, the word *good*, appeared quite naturally as a response to *savoursome*; it reappeared with *also*, where there is no other word to dispute its entrance and just after subject had said "I will be good"; with *majestic*, *spread*, *streaming*, *logical* and *chink*. At this point the test was dropped for the day. The word had become an obsession. Ev's experience with the word *black* is somewhat similar.

May 20.		
11 wind	blow	2697 For some reason had "black" in mind, had to be got rid of.
14 drab	black	 Recognized as color word. "Black" disappointed. Had just rejected in 11.
20 silvery	black	1801 "Black" just came, distinct feeling of disgust when it appeared.
May 27		
37 mirrors	shine	1558 Bothered again by "black." Think it may come from color of machine.

June 12

84 grim

Mr.

2272 "Dark" or "black" conflicting.

86 dusky

black

1052 "Black" has been a very common word with me in these experiments.

It will be noticed that the word is not spoken in this case unless it fits. Even in the extreme case of Y there is the same tendency, as the following reactions show.

58 spread

good

1374 Food-taste-good.

61 streaming

good

1071 Pleasant image of flowing down line.
Surprise at word.

71 logical

good

1184 Vague "hurry" of work on argument.
Then the connection between logical and good seemed clear.

Later in the case of *no* the same thing occurs.

90 yes

no

933

91 conterminous no

3174

Did not seem to be repetition, asked self if I had seen word. Answer "no."

Whether it is that the word has a strong tendency not to come, or not to come completely (to be inhibited), unless it fits into the verbal or other association group, or that while it is coming the mind makes a frantic effort to have it seem sensible, I cannot say.

T.

65 gold

golden (west)

2383

68 arcade

gold

3636

Something about the word—*rca*—(possibly brocade) suggested mellow, rich color.

Here there was need apparently for such a word, and *gold*, being ready, came.

S.

12 hum

bug

711

34 humble

bug

1050

A.

12 hum

bees

1864

34 humble

bees

971

Reports thought of 12 before giving association.

101 moist

day

1123

108 serene

day

1679

Tried to get body of water, wouldn't come.

This case is, perhaps, more association than perseveration.

R.

61 streaming water

1723

Brought back 59, murmur-stream complex.

Pure perseveration.

By.

35 carrot

top

1080

36 bell

top

1002

By's *it* is like Y's *good*.

19	remember	me	1590	
64	due	me	986	
76	analyze	it	1458	
92	Punch	him	966	
96	assimilate	me	1786	Very strong inhibition.
98	enjoyed	it	2161	Several personal pronouns in mind.
102	distribute	it	1579	Began to say "me" but refused.

These repetitions seem in some cases to be a sort of set, almost an Aufgabe in By's case, to respond with a personal pronoun to verbs. Certainly the place into which the word may come is pretty well controlled by whether or not it would fit there.

TYPES OF IMAGERY ILLUSTRATED.

It is evident from the introspections given that the common imagery is visual. Visual imagery appeared profusely for Y and E, in considerable quantity for H and B, and somewhat for By and S. With others it was negligible. It occurred before the reaction word for E, Y, B, By, T, Ev, and R. Visual-verbal imagery occurred occasionally for Y and By, at least once for R, B, and T. S from the time she "got a suggestion of 'stone' printed after 'cling,'" saw faint print images over or in place of or to right of the stimulus word in nearly all cases. She appears to have given herself an Aufgabe of this sort, just as Ev set himself for synonyms.

Visual-verbal imagery illustrated.

B.				
1861-62	Grant	1961	Visual of 1861-62 typewritten at top of page.	
Y.				
culture	German	1521	Saw KULTUR against dark background	
humble	meek	1099	Saw written The Terrible Meek.	
T.				
gray	grey	2374	Saw it typed alongside.	
R.				
comely	girl	597	Saw it written in book all together.	
S.				
majestic	theatre	1047	Pronounced. Almost saw "theatre" printed. Saw "Majestic" capitalized.	
clock	o'clock	885	Saw "o'" before "clock."	
jeopardy	leopard	1070	Transferred enough letters to make "leopard" appear in place of "jeopardy."	
low	bellow	877	Saw "bellow" in print in place of "low."	
punch	Judy	716	Faint print image a little to right (typical).	

moist	moisture	865	Saw "ure" added, though in a way image appeared separate from original word.
By. braes	Scotch	2026	Tried to think of meaning and thought of "Scotch" visually.

S also has what seem to be entirely visual-motor images of words, images "projected into space" before her.

gem	stone	933	Pronounced "gem." Faint air image of "stone."
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She says of these air images, "I don't see them exactly, but I know they are in a certain place, and that I am focussing my eyes on them."

Next to visual, the largest amount of concrete imagery or sensation reported is motor or kinaesthetic. To the reports that have already been cited in other connections, the following are added as being especially interesting or clear cut.

Y.			
briskly	quickly	488	Sense of motion, then "quickly."
streaming	good	1071	Pleasant image of a flowing down line. "Good" (perseveration) surprised.
jeopardy	danger	960	Swift, vague sensation of catching breath, as if a faint reflection of a dangerous experience, then the word.
vast	big	888	"Vast" seemed to swell till letters were giant ones, against bare cliff. Then the word.
H.			
briskly	walked	1074	Feeling of motion, arms, elbows, skirts. Some one on Engineering walk.
animated	expression	1376	Feeling of a face in motion. Not my face, anybody's.
B.			
briskly	trot	1515	Kinaesthetic sensation. The word. Then indistinct visual of horse.
R.			
carrot	top	654	Motor image of carrot before getting "top."
omnibuses	London	1272	Saw busses in motor way.

Auditory imagery was reported very seldom. The stimulus words⁵² which it was thought might induce it were not very successful. The majority of the responses were verbal, most of them quite automatic or capable of being so interpreted. With *grate*, *wind*, *chink*, and *rippling* the associations were all auto-

⁵² List of words: *rippling*, *hum*, *wind*, silvery, bell, clock, *murmur*, lapping, *chattered*, *chink*, bugle, jingle, grate, piping. The words that received the largest number of auditory responses are italicized. 'Clock' had no such responses, either in vocabulary or in imagery, and 'silvery' had one in vocabulary (silvery-voice) unaccompanied by an auditory image.

matic, though R and E did report auditory imagery with *rippling* (*—stream,—brook*). 78 of the words given in response, 117 responses, may safely be said to be automatically verbal of some sort. There were 53 reaction words with which sound might have been expected, but did not appear; as *murmur—bees, wind—howl, rippling—waves, lapping—plashing, jingle—jangle, piping—note*. There were only 17 reactions to these words that could possibly be classed as auditory—in the sense of accompaniment of word by auditory imagery. *Serene*, however, gave S verbal and musical imagery. Of the subjects, E had 7 auditory reactions, Y 5, and R, By, Ev, B, and H one each of which I could be sure. These results do not include the auditory factor that was probably present in the auditory-vocal-motor complex, in verbal imagery like that of H for example.

H.			
bugle	blow	1263	Thought of "Blow, bugle, blow."
S.			
serene	day	921	Song "This is the end of a perfect day" began to sing itself.
E.			
jingle	loathly	4034	(Complex train of thought, Spenser's "loathly lady.")
wind	trees	2390	Sound of wind in big pine woods. Visual of trees.
hum	bees	1218	Bees in alder tree, "just booming" in it. (Typical.)
Y.			
chattered	noise	1295	Picture of tree full of birds. Then big table at house.
B.			
chattered	squirrel	2059	Auditory image, then word, then visual image.
By.			
hum	bee	1323	"Bee" from sound of "hum." Then "Vergil." Said "bee" with "Vergil" in mind.
R.			
rippling	stream	979	Got sound of rippling and "stream" suggested itself.

UNANALYZABLE MENTAL CONTENT.

The following records of unanalyzable mental processes fall into the two groups made by Messer and others,⁵³ of intellectual and affective attitudes; of feeling-toned⁵⁴ and purely intellectual

⁵³ Messer, *Untersuchungen über das Denken*, p. 184. *Ach, Ueber die Willenstätigkeit und das Denken*, p. 213.

⁵⁴ The word is here used in its more general and comprehensive sense.

thought. The feeling-toned I have not sub-divided; the intellectual fall into two main classes. (1) A complex matter is present as a single attitude or impression, a good deal, as Ach⁵⁵ says, in a nutshell; remembrance of instructions or of conditions of task, and in some cases meanings, seem to come under this head. These contents like some much simpler might be explained as residual or partially excited groups of processes. (2) There is a sense of relationship, of a thing belonging to the same group or having the same pattern as another, a consciousness of likeness or similarity.

Closely related to these are the processes that show the influence of an idea not present as a distinguishable element, the control of a "determining tendency."⁵⁶

Feeling-toned.

Y. blue	red	899	Vivid picture of blue. Tension, word brought relief.
grim H. frog	sorry legs	 329	Sense of harshness, then word. A friend likes them. I don't. Feeling-toned.
logical	analysis		Cold bare feeling. Thought, what else is like that?
A. drab	dress		Immediate impression of something unpleasant. Notion of colored dress followed. Unpleasantness possibly due to symbolism.

Intellectual content.

(1) Complex matter appearing as single (simple) attitude or impression.

Partially excited imagery.

Y. medium	James	1455	Vague complex of spiritualistic practices. James' attitude toward mediums, then the word "James."
tapir	Beatrix	1347	"Animal" came first, then in "tumbled" the whole Beatrix incident (from a previous experiment).
equivalent	equi-valent	1163	Length made me pronounce to myself. Hurried flash of the Chemistry building and S. and a talk about different valences with S. a day or so ago.
braes	Scotland	787	Sense of cool wood with stream.

⁵⁵ Ach, Ueber die Willenstätigkeit und das Denken, p. 211.

⁵⁶ *Ibid.*, pp. 209, 228.

S. 1861-62	Civil War	1463	As said "Civil War," distinctly conscious of some previous experiment. Felt self in Miss S.'s room, though no definite imagery.
remember	dust	1642	Thought "that" first, but it didn't seem worth saying.
R. florid	face	470	Thought "Florida," but wanted to say something sensible.
dyes	red	2003	Rejected "red" as a verbal. Saw dyes and finally said word. (This, the two preceding reactions, and Ev's "sesquipedalian" below show the presence of an attitude of mind, a self given Aufgabe.)
heterogeneous Ev.	homogeneous	2267	Several unformed words came up.
sesquipedalian	nothing	3941	First tried to remember what word meant. Felt would not be able to get synonym; all the time feeling for word that would correspond in some way. "Nothing" sort of statement of failure. (This introspection shows very well the difficulty of classification. The feeling for word that would correspond, if not that for a synonym, is of the nature of a feeling of relation, and is given again there.)
Murmur golden	sound silver	1322 1888	Delayed by some poetical association. Bothered for a moment because didn't compare in form.
B. punch	bag	1087	Thought of "punch—", but "bag" came. Later visual of punch-bowl.
H. tide	time	1669	Feeling of darkness and line of poem I couldn't get, so said "time" instead. Now I know it was "Oh life's full bitter tide."
isobar	Isadore	1454	Thought first of word of three syllables ending in bar, a grand name. Then Mrs. _____'s name an easy substitute. Later "Conchabar."
<i>Meanings.</i>			
Y. severe ⁵⁷	hard	3203	Idea of sternness, associated vaguely with middle-aged woman, then word, all at the same time.

⁵⁷ This meaning, and others in the section on meanings in concrete form, recall Ribot's statement: "We learn to understand a concept as we learn to walk, dance, fence, or play a musical instrument; it is a habit, i.e. an organized memory." (General Ideas, p. 131, quoted by Titchener, Experimental Psychology of the Thought Processes, pp. 200-201.)

A. florid	complexion	1083	Repeated word. Knew quality of person. Thought of a cheek. Followed by articulatory tendency to say "complexion."
grate	fire	997	Hesitation as to which of two meanings to take.
Ev. fly	bird	1944	Hesitation (think between insect and act), surprised at reaction.
dichotomy	broken	3554	Knew it was separateness or twoness, and "broken" came first.
turf	race	1632	Understood in sporting sense, but for minute no word.

(2) Relations.

Ev. sesquipedalian	nothing	3941	All the time feeling for a word that would correspond in some way.
distribute	spread	1859	Distinctly suggested supplies to the Belgians. Groped for word to express that kind of distribution.
R. wit	humor	1476	Vaguely conscious before "humor" came that "wit" was one of a pair. "And" had tendency to come.
Y. bliss	gay	783	As saying "gay" had a feeling that it did not fit "bliss."
over	behind	685	Sense of small word meaning direction. Then "behind" popped in.
also	then	1343	Feeling of little nondescript grammatical word.
B. equivalent	geometry	2385	Placed in mathematical group immediately. "Geometry" first to come.
S. animated	pop-gun	930	Felt it was crazy. Image of the thing followed.
Ev. prose	verse	1376	Slight dissatisfaction. Missed <i>and</i> or <i>poetry</i> .
treasure	trove	1773	A waiting for and recognition of "trove" as the right word.
Orpheus	Eurydice	1642	Distinct feeling, who is the other one? Couldn't tell if it was other person or other word.
grate	great	1453	I do not know. I do not think that I visualized it; the first idea that occurred to me was that it was a word of several meanings and I just gave one of the others.

Influence of the idea in mind.

E. 26 broadens	road	1784	A broad white road, very dusty, fern and laurel along it, widens suddenly as it turns.
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27	olivaceous	trees	5992	Saw dusty olive trees, yellowish in the sun, with dark olives on them, by a dusty road.
28	culture	vineyards	2189	A very dusty, slowly sloping hill with grape vines, very heavy with dark blue grapes, on its terraces. I had a vague impression of lake water, blue and shining hot, between me and it.

INFLUENCE OF KIND OF WORD.

Very little influence upon imagery of the kind of word⁵⁸ given can be detected. The abstract terms (logical, due) do not as a rule produce imagery, and when they do it is only with the more imaginal subjects—E, Y, and H. E succeeds in interpreting most of them as connotative. For example:

wit	man	1453	Picture of a man laughing discreetly.
yes	eyes	4220	Girl looking up at man, telling him she would marry him.

Abstract words have a tendency, noticeable particularly with Ev, to produce meaning content in more or less unanalyzable form. In the case of "dichotomy" he "knew it was separateness or twoness, and 'broken' came first." Words of the sensuous class (hum, chill), though they have a tendency to produce imagery, have no marked tendency to produce it in kind, as was seen in the discussion of the auditory group. The objective (frog, bell) and connotative (treasure, vagrant) groups get a certain amount of imagery; the records of those subjects who have very little imagery would lead one to think that they are the most productive of imagery. The kind of word, however, does have a marked tendency to produce the same kind in reaction, the per cents varying from 84 with Ev to 41 with E; and words commonly produce others from the same general category. An interesting illustration of this last point came up in connection with experiment V of the preliminary tests, the making of word lists,—for instance, writing as many rhymes as possible in a minute to *speak*. The subjects were asked to report all the rejections, and one of them said that he had been a reporter and knew a great many words which he would not like

⁵⁸ Description of association test. Chap. I, pp. 6, 7.

to report to a lady and that he was afraid they would come up. At the conclusion of the experiment he reported that he had not been troubled by this vocabulary. It had not fitted the situation and had not come up.

SUMMARY.

The times, beyond showing that quick word to word reactions might be expected from Y and S and slow from B, Ev, and E, show a marked tendency of the presence of concrete imagery to retard the time, except in the case of Y, and to retard it more for the imaginal types of subjects than for the verbal, with the same exception of Y.

Concrete imagery occurs in considerable quantity with several of the subjects, with the imaginal types but not with all of them. 56% of Y's reactions and 97% of E's were accompanied or preceded by concrete imagery. It seems clear that concrete imagery having to do with either stimulus or reaction word occurred before the reaction word, and that such occurrence is to be associated with the visualizing, or other imagizing habit, of Y, E, H, and B, in connection with words, possibly in connection with reading, though the isolated word is, of course, quite different from words in combination, and much more emphatic. Mental content impossible of analysis by the subject appears frequently, is characteristic of some subjects, notably Ev, and must be taken account of in diagnosis. The difficulty here on the part of the subjects was to distinguish between what came before and what came after the speaking of the reaction word. Imagery developed very rapidly in many cases, especially during introspection.

CHAPTER IV

INDIVIDUAL DIAGNOSIS RECORDS.

The diagnosis sheets that follow summarize the information yielded as to the individual subjects, by the experiments of the two preceding chapters. I have added to this accounts of the speech and writing habits and other pertinent characteristics of the subjects, drawn from my personal knowledge of them, and a few reports of imagery from the experiments of Chapter V.

Experiments Summarized.

Preliminary Tests.

- I. Reading of descriptive passages.
- II. Spelling backwards, and pronouncing from words spelled backwards.
- III. Groups of symbols.
- IV. Words that sound alike but are spelled differently.
- V. Lists of words: rhyming to test auditory-vocal-motor, with the same ending to test visual.
- VI. Words that are spelled alike but sound differently.
- VII. Picture postcards.

The Free Word Association Test.

A.

(Fernald: Auditory-vocal-motor.)

- III. First group for 6 items, medium for 9. Method, largely visual motor.
- V. a. Third group.
 - b. Second group, high. Visual-motor supplemented by articulatory. Perhaps more visual than he thinks.
 - c. Second group.
- VII. Low rank. Poorer record for 10" than for 2". Verbal and visual, probably largely visual-motor. Many errors, especially in colors, due to association and naming and probably

to lack of color imagery. Reports often very full, but full of errors. Reports learning by eye and head movements. Noticeably verbal, but not so exclusively a naming process as he supposed. Tendency to use after images to lengthen time (see B). Delayed recall seems to be from a visual image. Least visual subject.

Association Test. Average time 1.589". General verbal 88%. Phrases 59, some logical and predicative reactions. (Verbal.) Noticeable lack of concrete imagery. None preceding. Imagery increases time 37%. Some verbal rivalry, more automatic reactions tend to come. Reversed verbal lengthens time. Some unanalyzable content.

Summary.

III-V. Visual-motor supplemented by articulatory. Fair record and fairly flexible.

VII. Low rank. Verbal, visual, visual-motor. Poor color imagery. Naming, associations. Recall from sort of visual image, nothing vivid about it.

Association Test. 7th in reaction time. Verbal, probably internal and automatic. Little concrete. Unanalyzable. Fairly flexible.

An instructor in psychology. The introspections in general are meagre. The subject does not find imagery to report.

B.

I. Visual, vague, unrelated. Kinaesthetic reported for smell. Very fleeting auditory. Organic and kinaesthetic sensations strong. Verbal memory good. Some unanalyzable impressions. Fairly flexible, slow.

II. a. Very slow. Vocal-motor and articulatory method, spells forward several times. Visual practically no use.
b. Time medium. Vocal-motor method. "Reversed in some way not visual."

III. For 6 items heads list, for 9 items second. Articulatory and visual method with associations.

- IV. Heads list. Auditory-vocal-motor method, visual as check.
- V. a. Third group, at foot. Purely articulatory method. Non-sense words inhibited. Slow.
- b. Third group, very slow. Articulatory rather than rhyming. Unable to use visual.
- c. Third group. Lack of flexibility.
- VI. Heads list. Articulatory, and probably motor imagery. No visual, no auditory reported.
- VII. Lowest rank. Visual, motor, verbal, meanings. Sees colors brighter than on card. Gets very little color from 2" exposure. Probable weakness in color imagery and holding visual factors grouped. Visual imagery in recall neither distinct nor accurate. Attention to balance, and tendency to draw, probably motor. Gets diagram in 2". Uses phrases rather than words in learning. Verbal method seems to help. Does not know how her delayed recalls come, has visual image in mind during description, built up, more a checking process than a remembered whole.

Association Test. Average time 2.265". General verbal 84%. Verbal phrases 60, a few logical and predicative reactions. Some visual-verbal. Some kinaesthetic, at least one auditory. Concrete imagery 31%, some preceding—images related to reaction word, causes delay of 62%. Verbal associations tend to overcome visual. Some verbal rivalry, less automatic tend to come. Great many reversed verbal, time lengthened greatly. Meanings in indistinct concrete imagery. Some unanalyzable impressions.

Summary.

- I. Visual vague, auditory fleeting, kinaesthetic and organic strong, some unanalyzable. Slow.
- II-VI. Low record except for VI. Vocal-motor, articulatory, schematic relation. Visual used only as check. Inflexible.
- VII. Lowest rank. Method largely motor and verbal, a little visual-concrete. Can build up visual as a check. Gets diagram very quickly, color slowly. Phrases rather than words.

Association Test. Very slow. Very verbal. Verbal overcomes visual-concrete. Good deal concrete which delays time 62%. Time greatly lengthened for reversed verbal. Some unanalyzable content. Inflexible. Internal verbal.

Group IV. a. The siren. Sentence followed by very fair small drawing of a siren—the side that had not been exposed to her! Her record for IV was very verbal.

Graduate student in psychology. Has worked in a number of experiments. Not musical. Draws. Rather slow of speech and movement. Not ready as speaker or writer.

By.

- I. Visual lacking or dim except when special need. Some lack of tendency to organic reaction. Considerable effect of rhythm. Verbal memory not good. Gets significance rather than words. Says musical memory is vocal-motor. Flexible.
- II. a. High record in time and correctness. Visual.
b. High record for both times, longer for 2 letters per second. Visual of word as group of letters. Guesses.
- III. Very high record for both sets. Articulatory, probably mixed with visual schematic.
- IV. First group. Used sense combinations and deduced in learning, checked by visual. More visual in recall.
- V. a. Second group. Automatic verbal.
b. First group. Highest. Vocal-motor, and visual for check.
c. First group. Flexible.
- VI. No record.
- VII. Highest record for 10" period. Very great improvement from 2" to 10". Visual, some verbal. Attention to color and light. Very distinct and accurate visual. Always gets lines before color, probably eye-motor. Recalls visual. Images of delayed recall seem firmer and clearer than of immediate.

Association Test. Average time 1.502". General verbal reaction 88%. Phrases 70. Concrete imagery 15%, a number preceding, many connected with the reaction word;

increases time 33.5%. Verbal association will overcome verbal-concrete. Visual-verbal occasionally. Some verbal rivalry, more automatic reactions tend to come. Some auditory.

Summary.

- I. Visual concrete lacking except when needed. Directed by words. Gets significance rather than words. Strong rhythm and vocal-motor. Flexible.
- II-VI. Very high record for visual-verbal. Second group for vocal-motor. Flexible.
- VII. Highest record. Visual very distinct and accurate. Eye-motor. Considerable verbal.

Association Test. Highest verbal record. Quick reaction time. Some visual-verbal. Some concrete imagery, increasing time a good deal. Automatic verbal marked. Flexible type.

Has been a newspaper reporter, is at present an instructor in rhetoric. Writes constantly both prose and verse. Very critical turn of mind. Musical. Very quick and observant. A lively and disputatious talker, and a very ready writer.

E.

- I. Concrete imagery emphasized by practice. Can use a great deal of visual without noticing confusion, but is probably confused. Smell. Auditory strong. Organic almost lacking. Rhythm memory marked. Many "feelings" (emotion-toned). Verbal memory not very good. Inflexible, visual-concrete. Very slow.
- II. a. Slowest time. Poor speller. Visual, confused, some vocal-motor.
b. Visual method gives quick times for short words, long times for long words. 2 letters per second, time improved greatly, used auditory aid.
- III. Medium group for 6 items. Low for 9. Articulatory and visual.
- IV. (Visual). Third group. Reports a good deal of visual. Visual-concrete and auditory.

- V. a Third group. Great deal of visual-concrete, lengthens time. Probable confusion.
 b. Third group. Ability to visualize interfered with rhyming habit.
 c. Third group. Lack of flexibility.
- VI. Fair. Mixed method. Auditory. Visual, both concrete and verbal.
- VII. High record, slow. Reports no verbal. Attention to color, pretty distinct but not always right. Picture not especially distinct or accurate. Vivified cards (motor). Recalls as if had drawn. Very great improvement from 2 to 10". Not flexible.

Association Test. Average time 3.356. General verbal 39%. Verbal phrases 14. Literary vocabulary noticeable. Concrete imagery 97%, 50 cases preceding, delayed time 42%. Most auditory. Time shorter for reversed reactions. Many meanings in concrete form. Imagery complex.

Summary.

- I. Concrete imagery emphasized by practice, especially visual and auditory. Rhythm memory marked. Much feeling-toned. Very slow. Considerable confusion. Inflexible.
- II-VI. Visual method very slow, improved by auditory-vocal-motor aid. Very low record. Visual-concrete distraction. Lack of flexibility.
- VII. High record, slow. Visual and motor. Much color. Recalls visual, no verbal reported. Not flexible.

Association Test. Slowest time. Word to word apparently automatic accompanied by concrete imagery. Auditory. Many meanings in concrete form. Inflexible.

2b. of Group III affords very interesting illustration of the auditory and rhythmic working of E.'s mind. Card shown was of ruins at Luxor, a gray print. At about 8" subject began to make marks. / 6 6 / 6 6 / 6^{slow} / She looked at the statue and "thought it had an eternal expression. Then I marked off the meter, and my mind made the sentence. *It made me think of the*

meter of a song. The meter sounded like gray tones, like the stone in the picture. It came in beats, I heard it. The heavy beats were *b* below middle *c* I think, the others a third lower."

Graduate student in rhetoric. A writer of delicate and fanciful verse. A very reluctant writer of prose. A very slow and rambling talker, but fond of talking. Probably some of the slowness due to self criticism, and some to nervousness. Has deliberately trained her visual and other concrete imagery as a preparation for the writing of poetry of a decidedly "imagist" cast.

Ev.

- I. Visual very fleeting, none from stanza. Draws from written descriptions. Got significance rather than images. Tactual, organic and rhythm strong. Good verbal memory for prose. Much unanalyzable.
- II. a. Time slow, low per cent of correctness both oral and written, worse for written. Method phonetic. Reports a feeling that the process is wrong.
b. Very slow time. Vocal-motor reversal. Great deal of guessing from first part of word.
- III. Medium group for 6 items, lowest for 9. Method articulatory and visual. Low record possibly due to slowness.
- IV. "Couldn't do it. Meanings funny. No visual."
- V. a. First group. Purely rhyming process.
b. First group. Mixed, auditory-vocal-motor with visual as test.
c. First group. Mixed method, flexible.
- VI. Lowest record taken. Apparently articulatory.
- VII. Low rank. Verbal for 10". Some visual. Attention to color and light. Practically no errors. Gets localization by light and shade. Tendency to draw. Delayed recalls visual, much color. Finds colors brighter than he remembered them. Named more for identification than for memory. Makes good record for the short exposures.

Association Test. Average time 1.866". General verbal 82%. Verbal phrases 23, synonyms 27. Consciousness of meaning. Concrete imagery 5%, lengthens time 25%. Con-

crete precedes in a few cases. Good deal of verbal rivalry, more automatic tends to come. Some reversed verbal, time lengthened. Meanings and relations in apparently imageless form.

Summary.

- I. Significance rather than words or definite images. Visual very fleeting. Verbal memory good. Great deal unanalyzable.
- II-VI. Very slow with II. High rank in V. Vocal-motor and articulatory. Mixed with visual for test in the visual tests. Visual not very successful. Much guessing. Flexible.
- VII. Low rank. Very dependent on associations and relations. Attention to color and light. Accurate. Visual syncopated. A little verbal.

Association Test. Slow time, fairly verbal, verbal not very automatic. Meanings. Little concrete imagery. Much unanalyzable. Flexible.

- 4 of Group III. Talked, not from a picture, but from some sort of mental record of the things in it. (The circumstances here are different from those of VII of Group I where the subject was deliberately memorizing.) Occasionally something comes back that I don't remember noticing—comes visually—but surely 95% of what comes I have consciously attended to. The record isn't in words usually, though it may contain words. Have a chain of ideas, images, symbols, words, all sorts of things, quite constantly. Images tend to come when usual process is not adequate. Wanted the right word for color of woman's gown, for instance, and got visual image of it.

An instructor in rhetoric, a trained artist. Very keen mind with a speculative and humorous bent. Writes a good deal and very well. Very deliberate and slow of speech as of other movements, talks well when he talks which apparently is not often. Vocalizes a good deal between words, especially when thinking.

H.

- I. Visual-concrete, vivid, colorful, of movement. Gets full,

unified and complete picture. Gets suggestions from word rather than direction. Auditory. Many feelings and impressions. Good memory of rhythm. Organic strong. Verbal memory of stanza very good.

- II. a. Time record like that of visuals. Probably vocal-motor, a motor reversal, "lost if you stop."
c. Slow record for 1 letter per second, still slower for 2 letters per second. Wrong guesses from portion of words. Vocal-motor.
- III. Third group. Articulatory and visual. Method improved for 9 items. Uses meaningful combinations.
- IV. Last. Learned by "saying." Much confused.
- V. a. Second group. Large auditory element. Many associations.
b. Second group. Visual method supplemented by articulatory.
c. Second group.
- VI. No record.
- VII. Low rank. Verbal for 10". No improvement from 2 to 10". Visual, motor. Much preoccupied with color. Recalls color that was not there. Due to vivifying picture, probably motor. Many feelings and impressions. Critical. Recalls from a picture, Detail full, not always accurate, influenced by associations. Details separated if she names. Naming confusing.

Association Test. Average time 1.558". General verbal 82%. Verbal phrases 63. High record for literary context and vocabulary. Concrete imagery 36%, delayed time 45%. Good deal of verbal rivalry, more automatic reactions come. Reversed verbal lengthens time. Much unanalyzable.

Summary.

- I. Visual-concrete, vivid unified picture, suggested rather than directed by words. Auditory. Very strong organic and rhythmic. Very good verbal memory.
- II-VI. Method auditory-vocal-motor and articulatory. Meanings in more or less imaginal form. Many associations.

- VII. Low rank. Use of words in learning breaks up image. Recalls as pictures, influenced by association. Much unanalyzable, feeling-toned.

Association Test. Time medium. Word to word association strong, probably automatic verbal. Good deal concrete, delayed time a good deal. Much unanalyzable. Probably inflexible.

An English instructor and a graduate student in rhetoric. A writer of fine and thoughtful verse. Artistic, enthusiastic. Sometimes talkative and quick of speech, inclined to self criticism, however, so that much of her speech, especially thoughtful speech, is deliberate, even stumbling.

R.

- I. Visual schematic. No visual for stanza. Color present. Smell, auditory, tactual, organic, present in unusual strength. Body motor or kinaesthetic habitual. Verbal memory and rhythm not good.
- II. a. Slow time. Perfectly correct. Method vocal-motor, probably usually articulatory.
b. Longest time. Learned to spell words backward (lip motor). Long time due to disinclination to trouble of reversing.
- III. Medium group for 6 items, about the same for 9 items. Articulatory and non-visual relationships.
- IV. Third group. Purely articulatory method. Poor.
- V. a. Second group. Some visual concrete imagery at first. Some visual-verbal.
b. First group, high. Auditory-vocal-motor and visual mixed.
c. Second group.
- VI. No record.
- VII. Good record. Schematic visual and motor. Verbal. Increase in per cent of details with increase of time, more visual, more verbal. Not interested in color. Got it in a black and white print. Colors mixed him up. Accuracy good. Great deal of motor, eye motor for position. Recall

through motor, visual-concrete, or verbal phrase. Flexible.

Association Test. Average time 1.462". General verbal 74%. Phrases 46. Presence of literary vocabulary and phrase marked. Concrete imagery 22%, some preceding the reaction word; lengthens time 27%. A little visual-verbal. Kinaesthetic and auditory. Considerable verbal rivalry, more automatic reactions come. Much reversed verbal, time considerably longer. Some unanalyzable. Flexible.

Summary.

- I. Visual where it occurs schematic; smell, auditory, organic, motor, a good deal.
- II-VI. Articulatory, and motor relations. Difficulty in reversing. Auditory-vocal-motor and visual method gives better results than auditory-vocal-motor. Fairly flexible.
- VII. Good record. Schematic, visual and motor. Improves with time. Color confused. Good deal of eye motor. Delayed recall visual, motor, or phrase. Noticeably verbal. Flexible.

Association Test. Average time third. Quite verbal, probably both automatic and internal verbal. A little visual-verbal. Considerable concrete imagery, motor and visual. Good deal of unanalyzable. Very flexible.

Graduate student, psychology and medicine. Likes to talk, but dislikes very much to write. Musical, whistles while writing, not a distraction.

Rg.

- I. Visual-concrete, clear, slow stages for movement. Rhythm. Gets visual complexes very much syncopated, almost imageless. Verbal memory fair. Feeling-toned impressions. Somewhat inflexible.
- II. a. Time medium, smallest per cent right for oral. Great improvement for written. Method mixed, visual and vocal-motor. Written "much harder," time doubled.
b. Slow. Had to have several spellings. Visual, guessed.
- III. First group for six items. Third for 9 items. Articulatory, some visual. Meaningful combinations.

- IV. Second group. Used meanings and some visual. Method improved.
- V. a. Second group, lowest. Not a rhyming process. Based on auditory and visual similarity of form.
 - b. Second group. Probably auditory-vocal-motor and visual form.
 - c. Third group. Mostly auditory-vocal-motor. Not flexible.
- VI. No record.
- VII. Fair record. Visual, some verbal especially in 10". Attention to color, but often wrong and mixed up. Not accurate. Recalls rather hazily as pictures. Gets color tone before individual figures come. Pictures much changed. For 2" saw pictures as a whole in recollection, for 10" tried to burden mind with details, lost single impression. Verbal seems to be a poor method.

Summary.

- I. Visual-concrete clear. Tendency to much syncopated visual complexes. Rhythm strong. Somewhat inflexible.
 - II-VI. Mixed method, visual and auditory-vocal-motor, the latter not a rhyming process. Not flexible.
 - VII. Fair record. Visual, some verbal, means confusion. Color often wrong. Her visual not very successful. Cannot handle much detail at a time. Little relation between visual and verbal. Not flexible.
 - a. of Group V. The flower jug. First sensations of color, the metallic lustre and the background, then the shape of the thing. The Chinese bag. Feeling for the texture of the thing as well as for its color.
- A graduate student in chemistry. A very reluctant writer. Not talkative except under favorable circumstances. Musical.

S.

- I. Visual-concrete, occasionally definite and fragmentary, more often fleeting and general, nothing fixed about it. Some auditory and organic. "Feelings," especially of locality. Verbal memory not very good. Much unanalyzable. Flexible.

- II. a. Good record. Mixed visualizing and pronouncing.
b. Good record. Time rather better for 2 letters per second. Guesses. Reports still more mixed method, auditory-vocal-motor and visual.
- III. Second group. Visual-motor, and associations.
- IV. "Made sense," deduced. Some help from visual.
- V. a. Second group. Mixed method.
b. Third group, lowest. Rhyming method, interrupted by slow visual.
c. Third group.
- VI. Auditory imagery clearly present.
- VII. Very low record. Visual, associations, verbal for 10". Low rank for 10" due to distracting images and ideas. Color a secondary consideration, probably a weak image. Visual neither distinct nor accurate, disordered. Locality sensations probably visual-motor. Cards come back vaguely as pictures. Associations interfere with accuracy.
Association test. Average time 1.182". General verbal 84%. Phrases 46. Stimulus from word form, through both appearance and pronunciation. High record for literary context. Presence of literary vocabulary and phrase marked. Imagery largely visual-verbal. Reversed verbal mostly visual, time about the same. Much unanalyzable. A little concrete imagery, increased time 24%.

Summary.

- I. Visual-concrete definite and fragmentary, or fleeting and general. Some auditory and organic. Some unanalyzable.
- II-VI. Mixed method, auditory-vocal-motor and visual, the latter largely visual-motor. Tendency to deduce and make sense. Not flexible.
- VII. Relative standing very low, dependent upon associations which interfere with accuracy. Recall, vague pictures.
Association test. Quickest time. Visual-verbal largely. Much unanalyzable. Apparently flexible.
English instructor and graduate student in rhetoric. Not much of a talker and rather slow of speech. Use of words in writing

unusually exact and discriminating. Not musical. Philosophical bent.

Sc.

- I. Visual clear and unified. Organic not strong. Feeling of position and attitude strong. Verbal memory good. Some unanalyzable. Flexible.
- II. a. Highest time record. Record for correctness, oral low, written perfect. Method visual and vocal-motor, visual not very trustworthy.
b. Time somewhat longer for 2 letters per second. Very good guesser. Method, visual and auditory-vocal-motor. Builds the word up out in front, sees it but not distinctly.
- III. For 6 items second group, for 9 items highest. Articulatory and visual. Perseveration marked in recall.
- IV. Second group. Articulatory and visual.
- V. a. First group. Rhyming process. Some visual-verbal appearing.
b. Second group, high. Probably visual supplemented by articulatory.
c. First group. Very flexible.
- VI. Tried to remember pronunciation by remembering meanings. Probably auditory-vocal-motor.
- VII. High rank. Visual, and verbal in 10" exposure. Colors more vivid in recall than on cards. Seems to lack names for colors. Claims good color imagery. Accounts quite accurate and definite. Marked tendency to draw. Recalls come back definitely in visual imagery, much detail. Thinks names and visual images extremely closely connected. Puts down what he "remembers," rather than what he sees.

Summary.

- I. Visual clear and unified. Motor strong. Good verbal memory. Some unanalyzable. Flexible.
- II-VI. High record. Auditory-vocal-motor, visual-motor and articulatory. Much guessing. Very flexible.
- VII. High rank. Visual and some verbal. Colors very vivid, not

connected with words. Recalls, visual and detailed. Thinks names and visual images closely connected. Flexible.

An instructor in rhetoric. Talks well, rather rapidly and a good deal. Writes easily and a good deal. Strong sense of humor. Uses a great many gestures.

T.

- I. Visual-concrete clear, complex and unified. Suggested rather than directed by words. Does not get significance quickly from words. Good visual memory. Auditory. Some organic. Probably motor. Not very flexible.
- II. a. Good record in time and high correctness for oral. Written not so good, loses in both.
b. Good record. Time longer for 2 letters per second. Visual.
- III. Second group for 6 items, higher for 9. Method articulatory and visual-motor, improves by visual relationships.
- IV. Second group. Some visual imagery, method becoming more visual. Use of meanings.
- V. a. Third group. Visual imagery with auditory-vocal-motor. Slow, unused to rhyming.
b. Second group. Visual supplemented by articulatory.
c. Second group.
- VI. Auditory, aided by articulatory and some visual-concrete imagery.
- VII. Fair record. Visual, and probably motor. Makes her improvement between 2 and 4". Remembers colors very accurately. Record fairly accurate, not very full. Recalls come back as pictures. Very few errors. No verbal imagery recorded.

Association Test. Average time 1.564". General verbal 90%. Verbal phrases 15. 62 reactions apparently due to influence of visual form of stimulus word. Concrete imagery 6.3%. A little preceding. Imagery lengthens time 43%. Some verbal rivalry, more automatic tend to come. Some visual-verbal. Some reversed verbal, time not lengthened.

Summary.

- I. Visual-concrete clear and unified. Suggested by words rather than directed. Probably motor. Not very flexible.
- II.-VI. High record for visual processes. Auditory-vocal-motor slow, supplemented by articulatory. Shows greater flexibility here.
- VII. Fair rank. Visual. Accurate color memory. Reports not very full. No verbal reported. Recalls as pictures. Probably some loss in accuracy by association.

Association Test. Medium time. Word to word association strong. Probably automatic verbal. Very little concrete imagery. Some reversed verbal, time not lengthened. Imagery lengthened time 43%.

- a. of Group IV. The flower jug. Complex matter present in mind, feeling-toned. Recall of moist rather heavy air of a basement flower shop where it was bought. Earlier than recall of buying, saw the vase on a bookcase at home.

Incidental introspections from T bear out the conviction that her thought is essentially wordless when the motive of direct communication is absent. One day after working on the experiment, she said that while a group of us were talking she saw out of the window three sophomores in a row go by, against the background of the Law Building, and was conscious of the odd and gay effect of the three red sophomore caps, without, she was certain, the presence of any verbal element until she undertook to tell me about the experience, when the words came quite automatically. At another time she said, "Look at that awful yellow coat! Now I didn't have any difficulty saying that sentence. But if I had been alone, hadn't been trying to express myself to you, there wouldn't have been any sentence in my mind, or any words probably, just an idea."

A zoölogist. Writes a little, scientific papers and reports. Not talkative. Rather slow and deliberate of speech, but of enthusiastic temperament. No musical ear.

Ty.

- I. Visual-concrete when present clear, slow stages for movement. Attention to words. Smell, organic, and auditory

present. Feeling of position and attitude strong. Complex and feeling-toned unanalyzable impressions. Verbal memory very good.

- II. a. Very high record in time and correctness. Visual.
b. Highest time record. Shorter for 2 letters per second.
Visual and auditory-vocal-motor mixed. Guesses.
- III. First group for 6 items, highest record for 9. Articulatory, schematic relations, probably visual.
- IV. Second group. Some visual, method not systematic.
- V. a. First group. Auditory-vocal-motor, a little visual-concrete.
b. First group. Auditory-vocal-motor and visual mixed. Visual reported most important.
c. Third group. Possibly a visual preoccupation. Lack of discrimination.
- VI. No record.
- VII. High rank. Practically no improvement from 2 to 10". Visual, visual-motor, some verbal. Attention to color, to light and shade. Vivid colored imagery, brightnesses more likely to be right. Accounts quite distinct and accurate. Marked tendency to draw. Many feelings and impressions. Delayed recall, visual and some phrases. Images of delayed seem firmer and clearer than those of immediate recall. Influenced by associations.

Summary.

- I. Visual-concrete clear when present. Attention on words. Motor strong. Verbal memory good. Much unanalyzable.
- II-VI. Very high record except for V.c. Method visual or auditory-vocal-motor and visual mixed.
- VII. High record. Visual method. Distinct and accurate. Attention to color and light. Some phrases in recall of cards. Tendency to idealize. Much unanalyzable. Allows herself to be directed by words, but takes only suggestions from visual-concrete stimulus. Verbal probably mostly automatic.
- A senior woman with decided literary talent, for both prose

and verse. Musical and artistic. A lively talker and an enthusiastic writer. Tendency to Kundgabe error. Instead of describing her thoughts she expressed them, as it was the constant effort of her life to do. Especially noticeable and troublesome in the last set of tests.

Y.

- I. Visual-concrete, definite, vivid, colored. Mainly concrete from stanza. Words unnoticed but directing. No rhythm. Probably faint auditory. Organic. Verbal memory fair. Some unanalyzable impressions, not feeling-toned. Inflexible, visual-concrete.
- II. a. Slow. Mixed method, emphasis on visual but image a general one. Poor speller.
b. Slow for 1 letter per second, much quicker for 2. Cumbersome visual method of reversal, worked so badly for 2 letters per second that she guessed.
- III. Very little success. Method articulatory and visual.
- IV. No record.
- V. a. Third group. Attention distracted by visual-concrete.
b. Third group. Auditory, tested by visual. Apparent lack of vocal-motor complex.
c. Third group. Inflexible.
- VI. First group. Auditory and visual-concrete principally.
- VII. High rank. Little change from 2 to 10". Visual. Very definite and accurate. Practically no verbal reported unless planning written expression. Thinks verbal does not help learning. Recalls came as pictures, "Saw the edges of the card." Images of delayed recall seem firmer and clearer than they were in the immediate. "I see perfectly." Tendency to idealize.
Association Test. Average time 1.205". General verbal 65%. Phrases 14. Very little indication of literary context or phrase. Concrete imagery 56%, many preceding; concrete delayed time only 4%. Rivalry of concrete images. A little visual-verbal. Good deal kinaesthetic and auditory. Reversed verbal time about the same or less. Many meanings in concrete form. Much unanalyzable.

Summary.

- I. Visual-concrete, definite, colored, unified. Words unnoticed but directing. Auditory but no rhythm.
- II-VI. Cumbersome visual methods. Attention distracted by visual-concrete. Auditory, but apparent lack of vocal-motor.
- VII. High rank. Visual. Little verbal imagery. Recalls card as such. Tendency to idealize.

Association Test. Very quick time. Very little delayed by concrete imagery. Reaction words related to imagery rather than to stimulus word. Some kinaesthetic and auditory. Some unanalyzable. Images seem to be simple, many of them partaking of the nature of synecdoche, a part representing the whole.

An English instructor, a graduate student in rhetoric. Charming and vivacious talker and story teller, but with a curious drawling vocalization between words, particularly noticeable when she is thinking as she talks. A very good debater but a slow and laborious writer. Not musical.

Y's quick time for the association test plus her lack of verbal record earlier and her non-automatic verbal record here may be explained by the extremely close relation both between images and words and between words and images wherever words are in evidence. In I, the words served simply to direct imagery; they did not anywhere seem to be much present as imagery—they are automatic motor reactions. A similar tendency though not nearly so marked is observed in S, Ev, By, and R, none of them so imaginal as Y. S and Ev have rather suppressed imagery and a good deal of unanalyzable content. By and R are more concerned with word to word associations, which are very weak for Y. All but Ev have very quick reaction times for this test, and Ev's reactions everywhere are slow. There is a group of subjects who have well developed associations between images, and well developed associations between words, without apparently much flexibility in passing from one to the other; most noticeable of these, perhaps, are T and Rg. H probably belongs to this class. but pays a good deal of attention to the careful fitting of words

to imagery—a slow process for her, probably of late development. E is somewhat similar, though with an engrossing interest in the imagery. Quick and automatic word associations characterize R and By, and probably, though they have no association test record, Sc and Ty. The last two have a great deal of imagery, approaching Y in that respect, and have certainly, like her, very close word-image-word relations. Their times in all tests are extremely quick. B has very verbal reactions of an automatic character, though very slow. She has a good deal of concrete imagery called up by words, but apparently the slowest reaction from image to word of any of the subjects.

The following scheme, with the most imaginal at the left and the most verbal at the right, gives as much of a grouping, probably, as can safely be made.

E	Rg	Sc	S	A
Y	T	Ty	Ev	B
	H	By		R

Although it is true that types cannot be grouped except in the most general way, I think the diagnosis records show that for each individual a *habit* in the use of imagery does become evident, modified, naturally, by the nature of the different tasks, but showing, after all, pretty constant elements and combinations. I am inclined to think that Miss Fernald makes too much of the differences in imagery for different tasks; there is, in general, a pretty well defined complex of tendencies. Her grouping of flexible and inflexible, as between verbal and concrete imagery, seems to me to be a useful one. The more flexible of my subjects are S, Ev, R, and By, with an emphasis on verbal, and Y, and probably Sc and Ty, with an emphasis on concrete imagery; the less flexible are A and B, with an emphasis on verbal, and H, T, Rg, and F, with an emphasis on concrete imagery.

CHAPTER V

EXPERIMENTS DEALING WITH VERBAL EXPRESSION AND WITH THE MENTAL PROCESSES PRECEDING IT.

DESCRIPTION OF THE EXPERIMENTS.

The experiments of Groups III and IV were planned to provide material for the examination of a subject's speech and writing in relation to his imagery-complex; and also of his mental processes from the arousal of an idea to its expression in definite verbal form, oral or written, more especially of the amount and character of the verbal imagery present.

In Group III the picture postals were exposed on gray cards by means of an apparatus worked by cords, as simple and noiseless as possible. The subject's chair was set about six feet from the card. He was allowed to modify the distance slightly if he just naturally moved his chair. All the experiments described in this chapter were carried on in a neutral tinted room of many windows, designed especially for the control of lighting conditions. The work was done during the clear daylight hours of the winter and early spring of 1916, the subjects coming at approximately the same hours each day. Nine subjects worked on these final tests. A stop-watch was used instead of a chronoscope because it was felt to be less obtrusive, and because, since the experiment was concerned with such general conditions, the differences in time shown by the watch seemed sufficiently exact. Other experiments should be made, dealing with more definite and minute portions of the process, and accompanied by a more exact time record.

In the first series of Group III eight picture postcards, three in black and white and five colored, were used. This series was considered preliminary, to accustom the subjects to the apparatus and the general nature of the task, and the investigator to the characteristic variations and peculiarities in response of the subject. The directions were as follows: "After I say *Ready* a pic-

ture postcard will be exposed to view. Say the first thing that comes into your head to say about it." The cards were exposed at first for a definite period, say 4", but as the covering of the card seemed to serve as a distinct stimulus to speech-reaction—a sort of precipitating factor—hurrying it and confusing the subject, they were later left exposed until the subject had spoken, really a much more natural situation.

If the responses came in single words and short descriptive phrases, as they commonly did, the direction to respond with a complete statement was given with the fourth or fifth card. The time elapsing before speech was taken with the stop-watch, and occasionally the time occupied in saying the phrase or sentence. Introspections were asked for, covering the time from *Ready* to the beginning of speech, and further if anything significant occurred.

Series 2 consisted of ten cards in groups of five each, chosen so that the cards of the two groups were as nearly similar as possible in interest, and in type and complexity of subject. For the first five (2 a) the subject was asked to respond orally with the first complete statement, impression, opinion or the like, that came to mind, the word judgment being deliberately avoided; for the second five (2 b) he was asked to turn to the table as soon as he could write a complete statement and write it out. The expression of the sentence in both cases was followed immediately by a written introspection covering the whole process, and times were taken at significant points.

Series 3 was made up of four colored cards (Tuck's Oilette Series), which were shown with the following times and directions:

1. Observe carefully. (Card exposed 5".) Write a brief description of the scene, such as might occur in a theme or a letter.
2. Observe with a view to writing a brief descriptive theme. (Card exposed 5".) Write.
3. Observe carefully. (Card exposed for 10".) Describe what is to you the most interesting thing about this picture.

4. Observe, in preparation to giving your impression afterward in artistic written form. (Card exposed 10".) Write.

The time spent in writing was taken with the stop-watch.

In series 4, the cards were similar to those of 3, the directions were modified for expression in speech, and the description of the cards was oral. Times were noted by the investigator, and a shorthand account was taken by a stenographer in the next room (her presence unknown to the subject), so that the times and character of oral expression might be compared with those of written expression in series 3.

In Group IV stimulus objects were exposed by turning on a light over a table in the next room, a darkroom, the room in which the subject sat being in darkness except for a little light which entered through one partly opened shutter. (A desk light was used at first but was not very satisfactory.) As the subject faced this light until he turned his head at the signal *Ready*, his eyes did not become especially adapted to the darkness. Four objects (a) were exposed, for 5" each, the exposure followed by a written description—a reproduction in words of the object or of the subject's impression of it,—preferably in a single sentence though it might be longer. Four objects (b) were then exposed with the direction that the subject was to react with the first sentence that occurred to him. Among the objects shown were two complicated pieces of apparatus from the psychological laboratory, an 'antique' flower jug, carrots, an embroidered bag of Chinese workmanship, an ivory fan, two comical white china figures, a book with a brilliant red cover ornamented with gilt, and a shallow vase with a thin-stemmed pedestal. I feel that more could profitably be done with objects exposed in this way.

This particular kind of reaction to stimulus—speech—offers the difficulty that not only must stimulus be offered, but in order to get typical and useful results the subject must have a motive for reacting to it in terms of speech. In general, the direction to respond in such and such a way, was not in itself sufficient. Motivation in the sense of the presence of an audience was often given by the presence and evident interest of the investigator.

If the result is to be anything but mechanical, a feeling of some sort of vitality of connection between the audience and what is said to it is necessary, and is very difficult to achieve. The conditions of the experiment, therefore, though as far as possible under experimental control, were made as little mechanical, as much like ordinary human intercourse, as might be. The fact that I was well acquainted with most of my subjects was, I consider, a great advantage in this respect. Unless the conditions are comparable with those of ordinary intercourse, it seems inevitable that no real speech can result; speech is emphatically a social affair and must be observed under social conditions. Then, too, in order to get any mental content capable of introspection, it was necessary to induce thought processes of some kind, the more original—that is, stimulated by unfamiliar scenes, objects, circumstances—the better; for speech-motor responses to stimuli, like other motor responses, are very largely automatic, habitual, and therefore exceedingly hard to come at in consciousness. Throughout these experiments the motivation is the weak point; for which reason it has seemed permissible to utilize, whenever they offered, the accidental, spontaneous reports of their mental processes that have come in from some of the subjects. Real thinking is at any rate done in the laboratory in connection with the task of introspection.⁵⁹

OBJECTIVE RESULTS.

The Time Records.

The following table summarizes for all the experiments the results for the reaction times, that is, the times between the appearance of the stimulus and the beginning of speech or writing. The times are given in seconds.

If the times for the spoken responses in this table are compared with those of the association test and other tests a considerable likeness appears. Sc, Ty, R, By are quick, in practically the same order; Ev, B, E are as before very much slower; T's time, especially for written response, is slower than her previous records would lead one to expect, and Rg's for oral response is rather surprisingly fast.

⁵⁹ See Wundt's position, *Psychologische Studien*, 1907, 3.

THE REACTION TIMES
III. Cards.
IV. Objects.

Subj.	Spoken Responses					Written Responses			General Average	Percent of increase* of writing over speaking time.
	III. 1 words phrases sentences	III. 2a sentences	IV. b. words phrases sentences	III. 4 cont. speech	Average without 4 With 4	III. 2b. sentences — time of turning	IV. a. sentences	III. 3 cont. writing		
Ty	3.2"	2.5"	2.3" phrases	—	2.66"	$\frac{5''}{3.5''}$	—	9"	4.8"	90
Rg	2.3"	2.3"	2.6" sentences	4.6"	$\frac{2.4''}{2.9''}$	$\frac{10.7''}{8.8''}$	(12")	—	7.1"	346
Sc	2.66" sentences	1.5"	3.3"	2.5"	$\frac{2.48''}{2.49''}$	$\frac{4.2''}{1.8''}$	—	—	3.3"	69
R	2.44"	2.44"	3.6"	2.25"	$\frac{2.8''}{2.68''}$	$\frac{7.3''}{3.3''}$	9.3"	13.6"	6.34"	160
Ev	3.5" sentences	4.9"	3.07"	7.5"	$\frac{3.82''}{4.74''}$	$\frac{14.4''}{7.2''}$	6.5"	(1'22")	$\frac{7.6''}{(19'')}$	277
By	2.95"	2.25"	3.5"	—	2.9"	$\frac{5.3''}{2.6''}$	22"	—	8.2"	83
T	2.8" phrases	6.45"	2.9"	—	4.05"	$\frac{7''}{4''}$	—	24.6"	9.9"	74
B	4.03" some sentences	4.2"	4.3"	—	4.26"	$\frac{5.6''}{3.3''}$	26"	35"	13"	31
E	words sent. 5.2" II. " sentences	3.33" words sent. 8. " phr. 9.2" sent.	8. " av.	3.75"	$\frac{7.4''}{6.5''}$	7.1"	25.5"	33.5"	14.2"	4% decrease

* This comparison was based on the first average under spoken responses, and the times for III. 2b. under written. There seems to be an average normal increase of from 75 to 100% of writing over speaking time.

2 b affords the only available set of reaction times for written responses on which a comparison with the times for spoken responses can be based. The times, as would be expected, are much longer than for oral responses, except in the case of E, who seems to write short sentences at something less than her oral average. She is, as a matter of fact, accustomed to expressing herself in writing rather than in speech, and talks slowly and haltingly. Sc, Ty, and By keep their places at the head of the list, B rises from eighth to fourth place, E from ninth to sixth. R and Rg fall from third and fifth to seventh and eighth respectively. It is evident if these results are to be accepted, and they agree in general with the other records, that B and E express themselves more readily in writing, and that R and Rg do not express themselves in writing nearly so readily as they do in speech. If the per cent of increase in time for written (based on 2 b) as compared with spoken expression (1, 2 a, and Group IV. b) is considered, three of the subjects are seen to add enormously to their time, Rg 346%, Ev 277%, R 160%. Rg and R are not accustomed to writing and show a great disinclination for it; Ev is a writer and his long times may be attributed, in part at least, to his critical attitude toward his work. The increases of Ty and By, 90 and 83 %, may very likely be due in part to this same critical attitude, although there seems to be a normal increase for writing of at least 75%. E's time shows an actual decrease of 4% ; if her time for continued speech were considered this decrease would be changed to a very slight increase.

When the directions called for continued writing, say a paragraph or so as in 3, the subjects spent a considerably longer time in preparation. It seems probable from the introspections, that a kind of plan or 'feeling' of the whole is present in mind before this writing is undertaken. Preparation times for this experiment were not taken for the earlier tested subjects but those that were taken vary from 9" for Ty to over 30" for B and E and probably considerably more for Ev. Some of the introspections show clearly the presence of a plan.

The average length of time per word for sentences and continued discourse has also been determined, though the data is

somewhat incomplete for the earlier tested subjects. The times for continued discourse include pauses of all sorts. The average time per word for spoken sentences (2 a) is .446", ranging from .245" for Sc to .83" for Ev; for continued discourse, it is considerably longer, .744", ranging from .538" for Rg to .95" for Ev and E. The times for writing single sentences (2b) average 1.88", and range from 1.5" for Ty, Rg, and By, to 2.44" for Ev and 2.48" for R; for continued writing in the form of introspections the average is 2.7", minimum 1.8" for By, and maximum 3.8" for Ev; for continued writing with emphasis on literary expression (3), average 2.76", minimum 1.95" for By, the most practiced writer of them all, and maximum 3.48" for R, the most reluctant. On the whole, By, Ty, and B are relatively somewhat readier writers than speakers; R and Sc are much readier speakers than writers. Rg, T, E, and Ev show relatively little change. It should always be kept in mind that Ev, E, and B are essentially slow reactors.

Average length of time per word, in seconds. From Group III.

	Spoken words		Written words		
	2a	4	2b	3	Introspect.
E	.4	.674	2.48	3.48	2.9
E		.949		3.31	3.08
Ty	.41	.832	1.5	2.12	1.96
B		(.939)		3.12	2.57
Rg	.53	.538	1.5	2.28	2.8
By	.26	.747	1.5	1.95	1.8
Sc	.245	.624	1.9	3.38	3.29
Ev	.83	.947	2.44	3.35	3.8
T		.642		2.52	2.8
Av	.466	.744	1.88	2.76	2.7

Nature of the Vocabulary.

A rather mechanical investigation of the length in syllables of the words used in III, 2a and IV. b, oral, and III. 2 b, 3, and IV. a, written, was made by finding the per cent of words of two or more syllables used by each subject. For speech, the longer words run from 7.5 % of the total for E to 37% for R, with an average of 24%. For writing, the longer words run from 23% for T, to 37% for R, with an average of 29%. For T and By the per cent for spoken words is somewhat larger than for the written; for R, B, and Sc spoken and written are about the

same; for the others, the per cent of long written words is more than twice that of long spoken. I should have supposed that the use of more long words in writing would be universal.

A somewhat similar analysis was made of the verb element in the same experiments. A comparison of the per cents for III. 2 a (spoken) and III. 2 b (written) shows that for all but Ev, and By, there is a smaller per cent of verbs in spoken than in written sentences. With the exception of R there is a smaller per cent of verbs in continued than in sentence-length written discourse, an average of 23.6% in sentences, of 17.6% in connected discourse. R has for continued written discourse an unusually large per cent of verbs, 24; and E an extremely large per cent in the written sentence, 38. In the spoken sentence Ev has a very large per cent, 36.7, the next being Rg with 28.7%. There would be a temptation to associate many verbs with highly motor types, were it not that B has very low per cents of verbs everywhere. A further discussion of the verb occurs in connection with the sentence later.

The vocabulary used was studied very carefully, from the results of experiments 2 and 3 of Group III, and of the experiments of Group IV. The particles, conjunctions, prepositions, pronouns, minor adverbs, and verbal auxiliaries, were omitted, and other words grouped according to the classes of the association test,⁶⁰ as objective, sensuous, attributive, connotative and abstract (least likely to arouse concrete imagery). The classification is far from ideal but it was at least consistently applied.

Group IV, oral and written, was examined first. The average total number of words classified constituted 50.3% of the whole, of which the averages for each class were: objective 13.5%; sensuous, 6.4% connotative, 5.8%; attributive, 11.4%; and abstract 13.2%. The table below gives the per cents for each subject, and in *italic* his relative standing when compared with the common average. The numbers giving the relative standing are based on differences of 1%.

An analysis of these results would seem to show that E, Ty, and Rg have the most representative or concrete vocabulary; R,

⁶⁰ See Appendix. Association Test.

Vocabulary table from IV.

	ob.	s.	attr.	con.	abs.	tot. %
E	15.6% 2	14.8% 9	13.1% 2	11.6% 6	6.1% -7	61.2
Ty	12.5 -1	8.2 2	14.1 3	6.6 1	5 -8	46.4
Sc	14.4 1	2.7 -3	18.3 7	6.2 1	7.3 -6	48.9
Rg	15 1	6.7 1	14 3	8.2 3	10.9 -3	54.8
T	13.8 0	1.9 -1	10.3 -1	5.7 0	13.7 0	45.4
Ev	12.3 -1	4.3 -3	11 0	9.3 4	16.5 3	53.4
B	12.6 -1	2.6 -3	10.5 -1	5 -1	18.9 5	49.6
By	13.5 0	6.3 0	5.4 -6	4.3 -1	20.7 7	50.2
R	11.7 -2	4.5 -1	6.2 -5	1.6 -2	19.7 6	43.7
Avs.	13.5	6.4	11.4	5.8	13.2	50.3

By, and B the least. T's record is nearest to an average. The three most representative have been previously diagnosed as highly concrete in their imagery, Ty being also quite verbal. The three least representative are highly verbal. R and B have a good deal of motor imagery, By can be on occasion highly concrete but tends to suppress such imagery, as does Ev, when reading.

At this stage a similar analysis of the vocabulary in Group III, 2 and 3 was undertaken, to see if it would substantiate these results.

Vocabulary table from III. 3.

	ob.	s.	attr.	con.	abs.	tot. %
E	16.8% 1	2.9% -2	10.2% 1	2.9% -1	12.6% -4	45.4
Ty	15.3 0	3.4 -1	13 4	7.9 4	9.3 -7	48.9
Sc	12.5 -3	1.9 -3	11 2	4.8 1	13.5 -3	43.7
Rg	13.5 -2	4.8 0	7.8 -2	2.8 -1	16 0	44.9
T	18.3 3	5.9 1	11.2 2	4 0	13.6 -3	53
Ev	11.5 -4	7.8 3	4.9 -5	4 0	19.8 4	48
B	18.8 3	0 0	9.4 0	1.8 -2	14 -2	44
By	12.3 -3	2.4 -2	7.8 -2	4.2 0	19.7 4	46.4
R	18.7 3	11.2 6	10 1	4.9 1	24.9 9	69.7
Avs.	15.3	5	9.5	4.1	15.9	49.8

The results from the picture material are quite different in some cases. R makes here a representative record comparable to E's for object material, though he still retains his position as most abstract. E, although as before she is among the least abstract, has fallen off in per cent of representative words. Rg is considerably less representative here. Those who remain as before are Ty, in the most representative group, and By and B in the least representative. A consideration of both tables seems to warrant the following conclusions. R, Ev, By, all highly verbal, have the most abstract vocabulary; Ty and E, very highly concrete, the latter non-verbal, the least so. Ty, E, and R, all highly concrete in imagery, though R is also highly verbal, have the most representative vocabulary; B and By, both very verbal, the latter very visual but tending to suppress visual imagery when dealing with words, have the least representative; T, Ev, Sc, and Rg occupy a middle position, all of them having considerable concrete imagery, Ev not so much in connection with words as the other three and more verbal. The results for Group III are probably more trustworthy, since 3 under that group involved a considerably larger amount of material than there is in Group IV.

An examination of the sentences in Group IV as to emphasis and attitude shown gives some interesting results. Emphasis on color and light, E, Ty, and to a less degree, Ev, T, and Rg. Emphasis on shape, line, and size, R—size especially—Ev, Sc, and T and B not so marked. Emphasis on position, R and T, B and Ev not so marked. Literary association and connotation, marked for E, Ev, and Ty. Presence of other association, marked for T, less noticeable for Ty, and Ev. More purely scientific description, most noticeable in R, Sc, and B. Critical attitude, By, showing somewhat in Ty, and Sc. Attitude feeling-toned, E, and Ty, somewhat for T and Rg. An appreciation of *use* is noticeable in R and B. To a very marked degree these results are what might be expected from the diagnosis. (See diagnosis sheets, Chap. IV.)

Literary Excellence.

The more careful and leisurely continued writing of 3, under Group III, and the sentences from Group IV, I undertook to grade as to literary excellence, as I would grade a set of themes, using the markings *A*, *B*, *C*, and *D*. Seven years of experience as a reader of themes ought to make such grading fairly reliable. For 3, the subjects ranked as follows: *A*, Ev, and E; *A*—, Ty, and By; *B*, Sc, and T; *C*, Rg and B; *D*, R. R's faults are lack of complete sentence form and poor organization of material; his vocabulary is good. Ty to a considerable degree gets a feeling of her own from the picture instead of what is there; the combination sometimes gives the impression of superficial feeling. By's critical tendency is very noticeable. B, possibly because her phrasing is not due to habit and literary example, strikes out a few extremely effective descriptive phrases.

For IV, a, written, E, Ty, and Ev are *A*; T and Rg, *B* to *A*; By, *B*; R, B, and Sc, *C*. T and Rg do much better with objects; Sc and to some extent By are less actively stimulated by them and write somewhat perfunctorily. When b, the oral expression, is considered a number of changes appear. By heads the list, followed closely by E and Ev; T and Ty are *B*; B and Sc, *C*; Rg and R, *D*. The difference as it shows here between oral and written expression is, in general, what would be expected from the previous records. R, however, who is ordinarily a rather fluent talker, responds here with simple word identifications. The fancifulness of E and Ty, I should not hesitate to attribute to their habit of dwelling a great deal upon concrete imagery. It is possible that Ev's comparative suppression of definite concrete imagery goes hand in hand with his capacity for abstract thought.

The oral discourse of 4, Group III, is of a very rambling and fragmentary nature. Ty, E, and By produce a little material of the standard of literary prose; T, B, and Rg are very fragmentary; R's discourse, though connected, is very rambling; Sc and Ev stumble a good deal, though their sentences are fairly well constructed. Ev's oral expression, however, is far below his

literary standard. The more fluent in this test, judged by average time per word, are Rg, Sc, T, and R, in that order; the least fluent, the slow trio, B, Ev, and E. By's record here is slow, but he was fatigued when the test was made. If the comparative number of words to each stimulus card is considered, it is seen that Rg, though she speaks quickly, says much the least; R and Sc are not only quick but say by far the most; E, though very slow, says a great deal, and Ev is not only slow but says little. It is safe to say that R and Sc are fluent; that Ev and Rg are not; and that E is at least talkative. The general character of the content accords with this judgment. The test, however, was not very satisfactory. It should be repeated under something more like ordinary conversational conditions.

In general, those subjects show literary excellence who would, from the work they have chosen to do and the training they have had, be expected to show it. T, however, shows literary promise, and Sc for these quick responses shows remarkably little of the excellence which he really achieves in expository writing.

MENTAL CONTENT PRECEDING EXPRESSION.

One of the main reasons for giving the tests of Groups III and IV was to see how much could be learned about the amount and character of verbal imagery present before expression in word or sentence occurred. It was felt, moreover, that some light would be thrown upon the processes of thought and probably some upon the genesis of the sentence.

Verbal Imagery.

The following examples will give some idea of the amount and character of verbal imagery, and also of the differences in these regards between the subjects. The responses are in italic, words reported present in mind are quoted.

E. III. I. ARCH OF TITUS. *Rome.* No verbal imagery. Picture sort of came alive—there was a marble arch. Identified by word.

ROW OF TENTS. No response. (Had been asked to respond

with a sentence. At end of about 15" moved as if to write but nothing came. At 20" was asked for introspection.) I liked the grays in it. Then I recognized the objects and vivified the picture. I did not feel like saying anything. I heard vague circus music like that in Peter Grim.

2b. CHILDREN PLAYING. The falling of the cover card at 5" was certainly a signal to write, seemed to break into her train of thought. She remembered a situation—concrete imagery—and heard the sentence said to her by the old woman who said it before. *Signorina, lei vuole andare là.*

V. b. VASE. 5" exposure. No response. First I made out the shape of the vase; then I saw it was like a very spread out white flower with a broad calyx which grew close to the ground. Then I began to think of the verse in the Rubáiyát about the tulip, and could get nothing but fragments.

T. III. 7. ARCH OF TITUS. *Woman in brightly colored clothes.* First thing was a general impression of a "gate" in Italy or Palestine or the like. Found picture pleasant. Liked particularly the blue. Word "Trojan" came up distinctly, quite different from the masses of words present in the mind in connection with picture.

2. a. STEAMER AT CHARLEVOIX. 2" exposure. *I was surprised at smoke arising.* I don't believe that I think in complete sentences.

The smoke seemed to produce a division of the picture and a sharp contrast between that and the blue water. There is something on the right, a dock or another boat. The struggle to make a sentence was great enough to drown the details of the picture. . . . The sentence forming was difficult, only two or three words coming, like "black smoke," "boat," "smoke," etc. I didn't have much difficulty writing this in sentences though.

IV a. CARROTS. 5" exposure. Remember saying "carrots" to myself. Thought of grocery store (mixed verbal and visual). Saw baskets on floor very indefinitely. May have sort of halfway said "grocery."

Rg. III. 7. ROW OF TENTS. 2" exposure. *Gray.* Realized that was supposed to say something—no words. Attention was on color.

2 b. LUXOR. Turned 6". Saw stone figure and started to say something about it, but it didn't work, just a feeling. Then saw—ladies with roofs on their heads. Then sentence came, knew it wasn't right,⁶¹ but association of classical architecture had been called up. *This is a picture of the Parthenon.*

BAY OF NAPLES.—Turned 13". Confused feeling of too much in the picture to pick out anything to describe. Started to use the city. Then tried to put in the mountain. Began "Picture of a city by the mountains" realized it wasn't a sentence and said to myself—"Oh dear, I can't think of a sentence," realized it was the first sentence definitely thought of so had to put down, feeling sort of trapped.

IV. b. OWL AND FIGURE. (Forgot instructions.) A kind of confused searching for a name—with "The Owl and the Pussy Cat" somewhere in the back of my mind, but knowing it was not at all the name of the objects.

EV. III. I. DELPHICA. *That's Michael Angelo's.* I had certain of his painted prophets and sibyls in mind at once, and was trying to identify this.

2 b. JAPANESE CHILDREN. Turned 5", began to write 13". *Twins—not twins because one is taller—Japanese children.* I think this is something like the order of my first thoughts, although I am not sure how much of it was really thought in words. I am sure that "twins" and "Japanese" were, before I turned to write. Second item was probably just an image—not in words—an impression of relative size translated into words.⁶² Often parts of thoughts are in words, and part in other faint impressions. (In general visual not verbal imagery is suggested by the cards to this artist.)

IV. b. BOOK. *Those are birds—aren't they?* Had to force self

⁶¹ Other cases of censorship: Ty. STEAMER AT CHARLEVOIX, p. 110; B. CANAL, p. 111; R. VASE, p. 117. The matter of censorship is discussed by Pillsbury, *The Mental Antecedents of Speech*, p. 121.

⁶² Pillsbury's statement, "There is never or extremely rarely a sequence of ideas that comes before speech and can be said to be sufficiently detailed to be translated into words" (*Mental Antecedents of Speech*, p. 121) is too sweeping for the results of these experiments. See Ev. Book, p. 109; Sc. APPARATUS, p. 110; R. CHILDREN PLAYING, p. 111.

to say. Quite consciously the sort of thought that you think for your own benefit. Didn't have that thought to communicate, but was trying to identify the little flecks. Little bit more aware of turning it into words. Effort was thing noticed, and afterward a feeling that it should have been a question.

Sc. III. I. DELPHICA. 3". *Picture in a gallery evidently. . . . It's a . . . can't make that out.* Think I had the word "classic" in mind. Roman or Greek. Felt ashamed because not able to place her immediately. What does she mean? Can't name her. Arms attracted attention. Turned to printing, to last word. This was practically little snatches of statement, a good many of the nouns are here as words—they're not complete—very, very short things. Don't call in all the words that would use in expression.

IV. b. APPARATUS I. 8". *I see an instrument of some sort.* (Sentence faded out at the end.) Distinct jump from getting the thing and having it ready to express, and expressing it. The jump to expression, 'terming' the thing, a process I wouldn't go through unless I were going to express. I think we go about getting things like that all the time without naming. Satisfied with general nature of it and ready to quit, when it occurred to me that I was to put it in a sentence. Then it didn't *mean* much to me.

Ty. III. I. BULLOCK CART. 3". *Japanese—or Javanese—or—Filipino or Cuban.* 6". *Something tropical.* Saw man's hat right away, Japanese—and bullock, then palm trees in background. No words attached. No words found except those spoken. Didn't think when I said it where Java was or what it was like. Began to collect a geographical scene when said Filipino—to put elements of picture together and notice of what region they were characteristic. Thought palm trees more appropriate to Cuba. The last thing I remember was—what under the sun is in that cart? Not words—just a general sense of puzzling wildly, trying to get something the fruits looked like.

2 a. STEAMER AT CHARLEVOIX. 2". *It is a boat.* After *Ready*, conscious of modeling sentences like "This is green," etc. Card appeared. Pretty blue harbor. Nice light-house. The "smoke" would be very nice to say something about. (None of this repre-

sents words except "smoke".) I was amazed to hear myself saying *Boat*—hadn't the remotest idea I was going to use that word; in fact, I was trying so hard to think what kind of a boat it was that I felt the word to be inadequate if not inaccurate. Felt regret that I did not say something about the smoke.

By. III. 1. ROW OF TENTS. 3". *Plattsburg*. Word "tents" was the first word, and "summer camp" came into head. "Plattsburg" came, spoken before thought of, absolutely, unconscious as could be. Was surprised at word when it came out. Afterward thought of military camp at Plattsburg.

ARCH OF TITUS. 2". *That is an arch of triumph*. I thought it without any hesitation, or any intermediate steps. While saying it, identified the figure as a modern Italian peasant, and so had the conviction that the picture was a Roman ruin. "Hadrian" was indirectly concerned in the latter part of my thinking as a definite word image.

R. III. 1. BULLOCK CART. 2.8". *Country*. Had no time to think. It was green.

ENGLISH DOORWAY. 2.8". *Spain*. Looked southern. "Spain" present in mind, felt like muscles working in cortex.

2 a. STEAMER AT CHARLEVOIX. 3"—5.8". *Well—this reminds me of Long Branch*. "Atlantic City" was an alternative, very present and probably verbally.

2 b. CHILDREN PLAYING. Turned 3.5", writing at 6". *These children are playing a game of which I never was very fond*. Verbal element came in concomitantly with seeing and recollecting. Had most of it in phrases pretty much in mind before wrote. "These" occurred after turning.

LUXOR. Turned 3", writing at 7". *Alexandria is a very filthy city*. "Egypt," "Alexandria," "filthy," present verbally, and general background of unsanitary conditions which I had been reading about.

B. III. 1. DELPHICA. 2". *Woman*. Looking frantically for something to say when the word spoken *popped* suddenly,—seemingly from nowhere.

2 a. CANAL. 9". *That's a pretty drive*. "Drive" came up first.

then "pretty drive," "water," "horse," "pretty horse and buggy," was about to say this when thought verbally, "but it isn't a pretty horse and buggy." "Pretty horse," but this was not complete so looked for something else. Didn't want to say pretty anything, for it sounded silly. Then thought "drive" again and a feeling of push came as I realized the passing of time, and got the above.

IV a. APPARATUS. Exposed 7", began to write 44".

The object this time is a piece of apparatus for study of tones, and is called a siren. Followed by drawing. Recognized as piece of our apparatus. Verbal, "what is the brute anyway?" Probably verbal, "piece of electrical apparatus," had some of the feeling of the place it came out of. First thought of "tone" (verbal way down), then "siren." When started to write had a hunch it wasn't electrical. "Don't believe that is electrical." Words may have followed idea in mind, but so far as I can tell they accompanied or were the idea.

These introspections speak for themselves and give an idea not only of the amount and character of the verbal imagery for the different subjects, but of the other mental content preceding expression. If by thought "present as a whole in consciousness before the first word was reached,"⁶³ Wundt means, as he seems to, something total or unitary that precedes the observation in the mind of any imaginal details, or any development of the thought, then the subjects do not report it,—if present it was not described as part of the imagery content, and could be only an unanalyzable consciousness, of a relationship perhaps. On the other hand, Pillsbury's⁶⁴ anticipatory or preliminary intention seems to be lacking also, though it is somewhat a question of interpretation. The Aufgabe may represent here "the general in-

⁶³ "In such self-observations it became perfectly clear to me that the thought was not formed during the process of its verbal expression, but was present as a whole in consciousness before the first word was reached. At first none of the verbal or other images, which subsequently appeared in running through the thought and giving it expression, was present in the focus of consciousness, but these parts of the thought appeared successively as the thought was allowed to develop." (Incidental introspection during spontaneous thought.) Wundt, *Psychologische Studien*, 1907, 3, p. 349, quoted by Woodworth, *A Revision of Imageless Thought*, p. 2.

⁶⁴ Pillsbury, *The Mental Antecedents of Speech*.

tention to express something."⁶⁵ The "preliminary intention to express some particular thing, which is indicated by a most general mental content that means the thing in the vaguest way,"⁶⁶ is perhaps reported in the experience of Sc (LUXOR, p. 116), who thinks he "really got Egyptian the first thing and then justified it"; though I suppose this might also be interpreted as the total idea of Wundt! The differences between the results of these experiments and the conclusions of Wundt and Pillsbury may be due to the fact that they are considering abstract thought, whereas the material of these tests is concrete—in them the thing attended to may furnish the preliminary unifying idea. Thought seems, in many cases, as Wundt says, not to be "formed during the process of its verbal expression"; for instance, T says, "when I turned to write had that thought and had it in that order—hadn't said it as sentence to myself." In her case, and in Ev's (JAPANESE CHILDREN, p. 109), and in other cases where censorship takes place, notably T's on p. 118, AMALFI, there is indicated the presence of some sort of plan, or idea used for reference, which is not the sentence as expressed. In other records, by highly verbal types, there seems to be nothing that can be discovered previous to speech or wording (By. FAN, p. 122).

What Wundt means by "running through the thought and giving it expression" may occur in experiences like B's, p. 111, CANAL, or R's, p. 111, CHILDREN PLAYING. Shall this sort of thing be called analysis or development? I am inclined to agree with Pillsbury that "The course of each thought is really much more a development of its meaning than a mere analysis of what was present in it."⁶⁷ B's report on APPARATUS, p. 112, seems to be of the nature of the development of an identification. Introspections may be interpreted variously; probably Wundt and Pillsbury are interpreting similar experiences in their descriptions of the mental antecedents of speech. It seems obvious, at any rate, that mental content preceding speech varies for the same subject, and from subject to subject—is rather an infinitely vary-

⁶⁵ *Ibid.*, p. 120.

⁶⁶ *Ibid.*, p. 121.

⁶⁷ *Ibid.*, p. 125.

ing process than any set procedure. On this point I think the introspective records may be left to speak for themselves. Sometimes, and this is apparently typical of verbals, there is not only no preliminary or total idea but no analysis or development apparent; the subject's spoken words seem to be all the trace there is of the thought, an automatic reaction to something not observed (By. ARCH OF TITUS, p. 111; B. ENGLISH DOORWAY, p. 119; Ev. CHILDREN PLAYING, p. 121.) Sometimes a good deal of concrete imagery and fragments of words and phrases precede speech (Sc. DELPHICA, p. 110, LUXOR, p. 116; Ty. ENGLISH DOORWAY, p. 116, CASTLE AND SWANS, p. 117). The formulation of the sentence in words before speaking (Ty. APPARATUS, p. 117) is, in these experiments, extremely rare. I think Pillsbury underestimates the amount of concrete imagery preceding speech, but here again the difference may be due to the abstract nature of the thought he is considering, or to his own mental type.

The purely automatic character of much verbal reaction, that is, the lack of conscious imagery preceding it, is clearly demonstrated. Everywhere the process of wording itself seems automatic, incapable of introspection. The most one can do is, as Pillsbury says, "to pass upon this product as to its adequateness to the purpose in hand."⁶⁸ This automatic character applies to sentences as well as to words and phrases; there are, as it were, automatized sentence "patterns," to which our thought has been adapting itself since our earliest experience with speech.

All the subjects are at least somewhat automatic in their verbal reactions, all are somewhat verbal in thought content; but there are individual differences. B, Ev, R, and Sc are noticeably verbal in thought, R and Sc also noticeably automatic in reaction, as are By, Ty, and, less markedly, T and Rg. By and T are comparatively verbal in thought, though more automatic. E shows least evidence of either; the verbal content of her mind seems to consist largely of quotations and the like, and though talkative, she has very slow reaction times and rate per word.

⁶⁸ Pillsbury, *The Mental Antecedents of Speech*, p. 121.

Judgments.

It is impossible to ignore the fact that many of these reactions, if not, indeed, all of them, represent judgments. They range from a simple automatized identification or recognition to the expression resulting from elaborate though rapid processes of consideration of evidence. To those that have been given, the following, perhaps more clear cut, may be added.

The simple identification. (See E, ARCH OF TITUS, p. 107; Ty. STEAMER AT CHARLEVOIX, p. 110.)

B. III. 1. SNOW SCENE. *Brown City*. Identification. Forgot about the sentence instruction, and responded with the first thing that came.

Ty. III. 1. AMALFI. *Amalfi*. Thought of word the moment I saw it.

Ev. III. 2 b. LUXOR. Turned 4". *That is in Cairo*. He thinks simply the words "in Cairo" had come when he turned.

Verification present. (See By. ARCH OF TITUS, p. 111; Ev. DELPHICA, p. 109.)

T. III. 2 b. BAY OF NAPLES. Turned 4". *That's Vesuvius*. The card was nice. I noticed the yellow houses in the foreground and the lake, and the nice colors in the sky. Sort of squinted to see if the mountain in the background was a smoking mountain—it reminded me of pictures of Vesuvius. Then I cast about for a sentence, though it came more easily than usual. I think perhaps wonder about smoke was good sentence material, but I am sure it didn't come to words.

Sc. III. 1. ARCH OF TITUS. 1". *That's the picture of an arch*. Had the word "triumphal" in mind, think I dropped it to save time. Idea of Roman triumphs, dimly, not verbal. Felt big background of things in there, sort of sifting around. Thought also of fact that it was Italy—of fitness of arch to Italy. Noticed the peasant girl in foreground, strengthened Italian impression. Spoke. (This is a very good illustration of the enormous amount of suppression or exclusion of mental content at the point of expression.)

Judgments rising out of feeling.

Ev. III. 1. BULLOCK CART. 3". *It's cruder than the last one.* It carried a distinct impression of cheaply-colored-photograph.

Rg. III. 1. INVERNESS STREET. 2". *I don't like it.*

By. III. 2 a. AMALFI. *I expected that to be colored.* When I thought before the picture was shown that I wished to change the form in which I had been making statements, I thought of the noticeable green in the last picture shown, and was planning to respond in some way to the color of the picture. When it came I felt somewhat confused and expressed my confusion in the sentence.

These judgments seem to be almost, it not quite, as immediate as the identifications; they represent feeling in some way, rise out of the presence of a personal element in the reaction, such as surprise, confusion, approval, or dislike.

More elaborate forms of judgment. (See Ev. JAPANESE CHILDREN, p. 109; Ty. BULLOCK CART, p. 110; B. APPARATUS, p. 112.)

Sc. III. 2 b. LUXOR. Turned 1.6". (*That is*) *the picture of an Egyptian temple.* Spent most of my time trying to get the proper national adjective. Had Greek and Roman art in mind. Decided from character of figure in foreground and of columns (bigness and roundness in figure and in columns felt to be Egyptian) that it was Egyptian. Did this roughly. Then decided to call it "temple" because those ruins mostly are. Turned, got "That is," and wrote.

"Temple" is the only thing he is sure he named. Thinks really got Egyptian the first thing and then justified it. Thinks he didn't have words for Greek and Roman, just an other-arts-peculiar-to-regions-down-there feeling. Talked while writing—"I don't think in sentences. I don't gather my material in sentences."

Ty. III. 1. ENGLISH DOORWAY. 17"-25". *That door—It's an English door—some kind of late Gothic.* Pretty color—general impression but not a word. "Writing is upside down." Why? Fountain surrounded by "flowers." Is it a door or an archway? Thought of a door in "Martha Cook," visual. Kind of bringing evidence to bear. "Tower" and skyline are battlemented. What

kind of doorway is that? Had other words I don't remember. Forgot directions somewhat.

2 a. CASTLE AND SWANS. 3". *Not Chillon*....Has composition of usual views of Chillon, but that is not ruinous as this is, and is different color and is right on edge of lake. Visual, comparison of this picture with one I have of Chillon. I was not conscious of having to make a sentence, but the moment I said it I realized I had no verb in it. Neither saw nor heard the word Chillon.

IV. b. APPARATUS. *What in the world!* It's the back of something interesting (not words, it looks dusty and dingy and regulating), how perplexing. "What in the world" on two distinct occasions before said it aloud. I think it wasn't articulated.

By. II. 2 b. CHILDREN PLAYING. Turned at 3.5" and began to write. *That little boy is larger than my son.* The figure of the boy attracted my attention because of its position in the focus of the picture. I thought immediately of my own son who is perhaps a year younger than the boy in the picture. I had a very vague impression of him in an overall suit. While writing it down wanted to extend it but restrained myself; realized that a great deal had been added to thought content since the statement first occurred.

III. I. DELPHICA. 3". *Michael Angelo.* The picture aroused only a desire to identify it with a certain artist. I had a confused idea that the picture looked like the Medici statues of Michael Angelo. (Did not think it was one of them, but have a sort of schematic abstraction about a lot of artists in my mind, and think of those pictures as representative of Michael Angelo.) And felt sure that he was the painter, although I was not sure of any further facts.

R. IV. b. VASE. *Oh, dish.* For a moment cast around for technical word and didn't find it. Wanted to say "goblet," but it was not transparent; had "basin" in mind too, and "fountain"...

B. III 2 b. PERE MARQUETTE FLYER. Turned 3", writing 5". *The train's on the track.* Had a feeling of wreck, I suppose from the smoke. It did not come up as a word—just an indefinite. Then thought of possible location of scene—"California"

(verbal), and then west (indefinite). Idea of train wreck was in the background of consciousness and this sentence came up.

These processes of judgment are evidently carried on in many cases up to the point of expression, without words or with only an isolated word here and there, and with the aid of much concrete imagery. They come to expression in a single word or phrase as readily and satisfyingly as in a sentence. There does not seem to be any peculiar or necessary connection between a judgment and the sentence form or the presence of a verb.⁶⁹ Judging from the introspections and the statements of a number of the subjects, thought not only does not have to take place in related verbal form, or sentences, but it rarely does so take place. The verb, moreover, seems to be the least essential, the most artificial, part of the expression, at least in connection with this sort of material, where it is with few exceptions, whether present or understood, a form of *to be*.⁷⁰ (See Sc. p. 116; Ev. pp. 115, 119; B. p. 119; and Ty. p. 119). The verb that is distinctly the name of an action may occupy a different position; if the tests had called out narration the results might have been different. The exceptions to *to be*, mentioned above, occur in connection with the presence of feeling, where the verb represents the essential thing in the judgment, the feeling. That is, the verb does not represent an assertion, it is not a criterion of judgment.

Genesis and Form of the Sentence.

I add a few more introspections bearing more particularly on the genesis and form of the sentence.

Rg. III. 2 a. AMALFI. 3". "Monk" was the first word that came; then seeing stream I connected the two by saying, *Monk is sitting by the stream*.

T. III. 2 a. AMALFI. 5". *A rather gray sky was the thing that impressed me*. Could have said sky was grey color, but that wasn't what I was thinking of, and wouldn't reproduce my thought.

2 b. I am conscious from the beginning that I have to make

⁶⁹ Messer, Untersuchungen über das Denken, pp. 96, 105.

⁷⁰ Meader, The Development of Copulativ Verbs.

a sentence. Think the sentence "I've got to make a sentence" is in a way verbally present. When the picture comes the idea of making a sentence is overshadowed by the desire not to make a kindergarten sentence.

B. IV. b. OWL AND FIGURE. *The first thing was a youngster and then an owl.* With signal *Ready* looked into outer room and could just distinguish a patch of white and thought that must be object, so watched there. Had hazy idea of a cup, though was not aware of this, until I found it was not a cup, when I felt slightly disappointed. Had the feeling of recognition and "youngster" popped into mind. Turned to other object, "owl" came. Then thought—indistinct verbal—"you must react." Meantime "youngster" and "owl" had been running in my mind, so I said it.

III. 1. ENGLISH DOORWAY. 5". *A beautiful square* sprang up and escaped before I could notice whether it was complete or not.

2 a. STEAMER AT CHARLEVOIX. 2". *That's the steamer at Charlevoix.* Recognition. "Steamer" came to mind first, although I was conscious at the same time of water and pier. Thought "I have to have a complete sentence," and got "Steamer at Charlevoix," which was again censored and "That's the" added.

Ty. (See III. 2a. CASTLE AND SWANS, p. 117.)

Comment on 2 of IV a. No sentence tendency at all. When I have to write sentences always have to stop and think what kind of a verb would be nice. That's what makes a sentence get written slowly—have to fuss about the verb.

Ev. IV. a. CHINESE BAG. I continually safe-guarded myself toward having a sentence before I expressed any detail. *"It was a piece of fancy work"*—followed by participial phrase twenty-three words long.

BOOK. *Those are birds—aren't they?* Had to force myself to say. Quite consciously the sort of thought that you think for your own benefit, didn't have it to communicate. But was trying to identify the little flecks. Little bit more aware of turning it into words.

The presence or absence of a principal verb in these responses

from III. 1 and 2, and the difficulty revealed by introspection in achieving a verb, correspond closely to the subject's per cent of verb element for spoken responses (based on III. 2 a and IV. b) and almost as well, Ty not having the success that might be expected, to his per cent for written responses (based on III. 2 b and 3, and IV. a). Ev, By, R, and E are the most successful in getting complete sentences and have the highest per cents; Ty, B, Sc, and Rg have the lowest per cents and Ty, B, and Rg the greatest difficulty, Sc, a very flexible type, not so much.

I was interested at this point to see if any connection would appear between these results for individuals and Meader's⁷¹ statement for peoples: "It is especially among peoples whose thinking is of a concrete type that we find specific forms of copulativ expressions least developd." In the first place it should be noted that the subjects are dealing with very concrete material, and that this may account for their difficulty in achieving complete sentences, in using the more abstract verbs. From the examination of vocabulary (pp. 103-105) and from other classifications, the highest proficiency with the copula would be expected of R, Ev, By, and B; the least of E, Ty, Rg, and possibly T. The subjects actually most successful at sentence-forming, and to a large extent this means a ready use of the copula, are, as we should expect, R, Ev, By, and, as we should not expect, E. This exception may be explained in part by E's being a very slow and self-conscious reactor in these experiments, and given in ordinary conversation to talking as she would write, that is, in a rather literary and formal fashion. Those who have most difficulty with sentence-forming are Ty, Rg, to a less extent T, as we should expect, and B, whose record is verbal and abstract. In partial explanation of B's lack of success it should be remembered that she is a reluctant speaker and writer at any time, and an inflexible type. The matter is an interesting one for investigation.

The connection between achieving a sentence and having a motive for communication or expression comes out very clearly. When there is no such motive there is likely to be "a wild clawing

⁷¹ Meader, *The Development of Copulative Verbs*, pp. 197.

for a sentence," though to some subjects expression is so habitual a process that this extreme is avoided. Sometimes the desire to express an idea or opinion to the investigator has a motivating effect. The situation which most easily produces a sentence in this work, and is likely to produce one of other than "kindergarten" variety, is one that is in some way feeling-toned. The verb is present because it is representative of the reaction.

In III. 4, where there was a continual oral response, there is a very noticeable tendency to omit the verb, especially forms of the verb *to be*. This tendency, here as elsewhere, is particularly noticeable in pure, or passive, description. In T's description of the Fountain there are two main verbs and one participle in ninety words. In By's oral descriptions, which were unusually well organized with many somewhat complicated sentences, the more purely descriptive sentence occurs without a verb, which if there would be a form of *to be*, four times out of twenty sentences. The presence of feeling, here also, seems to be an energizing factor; Rg, who is especially given to omitting verbs in both oral and written discourse, when she reacts to The Two Boats says "That is very pretty. I like that. I like the sunset line and the water," etc.

All the previously unquoted responses that might have been affected by the presence of feeling follow. They are marked by quick times and the presence of a verb.

Rg. III. 1. INVERNESS HIGH STREET. 2". *I don't like it.* Antagonism was to task—sentence making—not to the picture. Had a feeling of wanting to push it away.

By. III. 2 b. PERE MARQUETTE FLYER. Turned 2". *I like the green color in that picture.* Verbal image of "green" present before speaking.

Ev. III. 2 b. CHILDREN PLAYING. Turned 4", wrote 8". *That is a funny little chap.* Sentence came naturally and I was not conscious of any process of formation.

T. III. 2 b. PERE MARQUETTE FLYER. Began to write 3". *That's a nice train and the water in the lake seems to curve down toward the track.* This picture was more interesting and at-

tractive. I think the sentence came quite quickly and verbally. I had an opinion about the picture, was not conscious of any struggle. When I turned to write had that thought and had it in that order—hadn't said it as sentence to myself.

E. III. 2 a. STEAMER AT CHARLEVOIX. 4". *I wish I was on that boat.* Imagery reported visual-concrete and unanalyzable.

Ty. IV. b. OWL AND FIGURE. 2". *Oh cutey!* Saw the word at the same time as said it. All three processes (including looking at figures) going on at once.

Rg. IV. b. APPARATUS. 2". Started to say, *Oh I don't* like it, but changed after *don't* to *I can't make it out.* Rg reports that the psychological effect on her of these experiments is quite different from that of the cards, the attitude of receptiveness is different. "The way it comes—it is distinctly pleasurable. Maybe because they are objects and not cards, but I rather think it is in the completeness of the way they appear, the suddenness, no distraction. There was a feeling of life about the process."

By. IV. b. FAN. The first impression of the fan was a feeling of pleasure which had nothing whatever to do with words or any formulation of thought. Even when I began to say what I did I was still "enjoying" the fan more than thinking about it. I was not sure as I spoke that there was any sense in what I was saying. *I suppose it's an added beauty to intricate design to have it made of something very solid like ivory.* (Directed to take his time. Finished in eleven seconds.)

The lack of verbs is undoubtedly due in part to the conditions of the experiment: to a feeling of hurry due to the timing, to the lack of ordinary conversational motive, to the fact that descriptive writing is asked for in several tests, and in others is naturally called out by the concrete material and the situation. Before any valid conclusions could be drawn as to the presence of verbs in oral discourse, at any rate, experiments which would tend to bring out a different kind of comment would have to be arranged.

CHAPTER VI

CONCLUSIONS.

From the results in Chapters II, III, and IV, it seems evident that the imagery type, or type-group, of an individual, though complex and varying somewhat from task to task, may yet be determined, and determined with sufficient clearness to make possible a rough grouping of individuals. A study of these types and groups in relation to the verbal expression of the subject and the mental processes preceding it may, then, be undertaken.

Can any influence of these types upon expression in language be observed?

From the results of the experiments described in Chapters III and V it may be said that the imagery type affects expression in language somewhat with reference to the type of vocabulary. I have always doubted the validity of the tests made on school children by Stern,⁷² Colvin,⁷³ and others, by which the imaginal type of the child was determined from the types of words preferred. Such a test would, of course, be much more reliable with little children than with adults, in many of whom the process of suppressing concrete imagery has gone a long way, as in the case of Ev. I was somewhat surprised, accordingly, when my study of the vocabularies used yielded something like positive results, though, to be sure, attacking the problem from this side is a different matter. The subjects who proved to have the most representative vocabulary, the largest proportion of words that might be expected to call up concrete imagery or sensations, were E, Ty, and Rg, all of whom had previously been diagnosed as highly imaginal types. T, though very imaginal, has not a very large vocabulary and is not accustomed to expressing her concrete mental content in words, as are the other highly imaginal types.

⁷² Stern, W., *Die Aussage als geistige Leistung und als Verhörsproduct. Experimentelle Schuler-untersuchungen*, 1904.

⁷³ Colvin, S. S., *Method of Determining Ideational Types*, 1909.

Of those who used the largest proportion of abstract terms, R, By, Ev. and B, all but Ev have been shown to be highly verbal; By with a tendency to suppress concrete imagery in connection with words; B with a tendency to use complex and dim imagery, often of an unanalyzable type; R, with a good deal of concrete imagery, largely motor, present in mind during reading or talking. The apparent discrepancy in the case of R, however, is really only the other side of a double tendency; though he has the largest per cent of abstract terms in the results from Group III, and the next largest in the results from Group IV, he has also, in the latter case, the next largest proportion of representative words. Ev's record is only fairly verbal; his strong tendency to use words of a rather complex nature, connotative and abstract, is to be correlated probably with the very large amount of mental content which—though a consideration of his introspections will, I think, convince the reader that he is an unusually keen and intelligent observer of the processes of his mind—he is unable to analyze. At the extremes, at any rate, it is true that the habitual use of much concrete imagery produces a representative vocabulary, and the lack of it a less representative, more abstract vocabulary. The poets E and Ty, I am interested to note, fall into the first group. Of the four using a more abstract vocabulary, Ev, B, By, and R, Ev, By, and R, in my judgment, have the largest working vocabularies of any of the subjects tested in the second part of this investigation; and B is very verbal in thought.

To a considerable degree the ability to give a quick oral response in Groups III and IV is correlated with quick time records in the word association and other tests. There is a difference for the subjects between oral and written expression, R and Rg being very much slower in written, and B and E faster. The tests of Groups III and IV show conclusively that word responses are often purely automatic, not preceded by any verbal imagery. The subjects who show this automatic tendency most markedly here are those who showed it also in the association test. The habit of automatic verbal reaction may occur where the use of words in thinking is comparatively slight.

This automatic reaction in words probably accompanies great fluency, or facility, in the use of words, and explains how such facility if not carefully checked may produce expression that is far from effective; for the automatized vocabulary is narrow and conventional, and represents very quick and often, therefore, very superficial identifications or judgments.

The introspections covering the period just preceding verbal expression show that words, phrases and sentences occur more or less freely in the mental content, the amount of this verbal imagery varying with the subject. It is evident, however, that these verbal elements do not by any means make up the whole stream of thought; they occur there in connection with a great deal of concrete imagery, some of it dim, vestigial, symbolic, some of it vivid, representative, and with other content that so far as these experiments go is unanalyzable. These other factors, like the comparative amount of verbal imagery, also vary demonstrably with the individual.

For the subjects that I have examined at least, thinking is not carried on primarily in connected verbal elements, in "literary form." Most of the sentences which occur before expression in the process of thought are, in truth, not essential parts of that process at all, but communication by the thinker with himself; they are critical, mandatory or the like. "I must wait till I have a complete sentence"; "but it *isn't* a pretty horse and buggy"; "What in the world!" "Oh dear, I can't think of a sentence." The reason why they are not as a rule recognized by the subjects as sentences for response is that they are not integral parts of his thought process, they are not in the line of his task, but by-products.

Concrete imagery, either definite or vague, and thought content so vestigial or complex or unrelated to any of the content usually described as imaginal as to be unanalyzable and undescribable by the subjects, function in these processes of thought. In my work upon unanalyzable forms of mental content I am well aware that I am on dangerous ground, the territory of imageless thought. But my concern is with a demonstration that thought processes occur in forms very far removed indeed from verbal,

in forms too complex and syncopated and swift to find automatic expression in words; not with any demonstration that this thought content is imageless in character.

The content of thought is, however, so far as my subjects were able to go with introspection, often imageless. It does not contain what in these experiments we have considered imagery—centrally aroused content of the same character as peripherally aroused sensations, or not differing from them in any other way than degree. Even in the thinking of the most imaginal subjects a great deal of content unanalyzable into images occurs. It does not seem to any of them that sensations like those from the chair on which they sit, or the lunch they have lately eaten, can be even remotely identified with the extremely complex and varying thought units that are continually presenting themselves in consciousness. Nor can all imageless thought be explained as the result of progressive automatization of any sort; the first appearance in mind of a significant relationship seems typically imageless. This imageless content may be preceded or followed by imagery; it seems possible that its accuracy may depend directly or indirectly upon the quality of previously experienced images, a definite and vivid imagery giving rise to right conceptions of likeness and difference. It is possible that kinds of relationships are recognized when they occur, or that the beginnings of arousal of many related images⁷⁴ may make a recognizable whole—of which the group relation, the unity, the togetherness, is the outstanding thing. Or it may be that such a togetherness may play its part in mental processes without even the near-presence of imagery in consciousness. I agree with Woodworth⁷⁵ when he says, "It appeared that imageless thought, the mere gross fact of observation, had come to stay, and that the only question was what to do with it." But it does not seem to me that Woodworth has helped matters much by adding the mental percept as the element alone which is recalled, if he has distinguished it from image, as he seems to have done, on the ground that it may be

⁷⁴ Ach, *Willenstätigkeit und Denken*, p. 217.

⁷⁵ Woodworth, R. S., *A Revision of Imageless Thought*, *Psch. Rev.* Vol. XXII, No. 1. Jan. 1915.

isolated. We have in practice always considered the image capable of isolation; we have, for instance, been able to conceive of abstraction. His discussion suggests anew the need of a treatment of what we mean by image, and particularly of a more extended treatment of the relation between image and mental percept as Woodworth conceives them. And I cannot see that in mental percepts, each of which is "specific, and contributes specific content," he has provided any better explanation for the presence of relationships in mind than we had before.

Thinking in words is not necessary either to clear thought or to clear expression. The expression will often follow purely automatically, as we have seen. By's account of his reaction to the ivory fan (p. 122) is an excellent example. Processes of judgment, which find expression in clear-cut sentences in from one to two seconds, go on without any demonstrable help from words.

I should like to repeat here, what was said in the introduction, that I am not under-valuing in the least the importance of language to thought. Language affords the means of social intercourse by which thought is fostered; its symbolism makes possible the development of the higher processes of thought. I am interested only to show that the sustained verbal, grammatical form of spoken language, of communication, is not the native tongue of thought, which is a more complex process. The writing of clear English results from clear thinking, undoubtedly, but not necessarily from clear thinking in words. Expression may be automatic, and it may be, as it is often described in the introspections, a "terming," a wording, a translation into words. And this translation process is easier for some types than for others, inasmuch as the type influences such matters as the nature of the vocabulary, and the verbal habit of the individual, and may even incline some individuals to deal with some sorts of materials rather than with others. The process of wording, however, if it is not immediately the cause of clearness, is at least a test of it, a test of the thought's social availability, a means of projecting it, for criticism either by others or by the self.

Expression in language, even for those who are practiced in it and make a business of it, is difficult even in words and all but impossible in sentence form, unless there is present a motive for communication or expression. A certain degree of excitement due to the presence of an audience—and the audience may be only the self—a desire to communicate, or an element of excitement or feeling due to the effect of the stimulus upon the person, giving him a desire to express himself, seem to be necessary to any adequate functioning of the power of expression in language, or presumably, in any other form. As to the occurrence of the verb, description, which is the form of discourse under which most of the speech and writing educed by this experiment falls, seems a comparatively verbless form. And it is certainly true that judgments come to expression, expression that seems perfectly satisfactory to the speaker and clear to the hearer, without the verb, except when action or personal reaction is the center of the thought. It is almost enough to make one conclude, as Meader seems to, that the complete sentence form is very often not natural or essential, but a conventional requirement of the rhetorician.

Though the individual is driven to *communicate* usually in verbal form, his imagery type will influence his choice of a means of *expression*. Literary excellence will depend somewhat upon the vividness and clearness and accuracy of imagery, even if only as a prerequisite to the growth of more complex and abstract forms of thought. Too great suppression of concrete imagery, too much substitution of abstract and symbolic forms of thought, will impair the vivid and representative quality of writing.

SUMMARY OF CONCLUSIONS.

- I. Types of imagery, though complex, may be determined with sufficient clearness to make possible a study of their correlations with other processes.
- II. Imagery types influence the kind of vocabulary, and to some extent the time necessary to react verbally.
- III. This verbal reaction is more or less automatic in character,

varying with the individual and with the originality of what he has to say.

- IV. Words, phrases, and sentences occur more or less freely in the thought process—varying with the type of the individuals.
- V. A great deal of imagery other than verbal is present in the processes preceding speech. It may be present as part, or all, of the process of judging; and may be very vague, or so vestigial or complex or unrelated to the content usually described as imaginal as to be unanalyzable, without affecting the clearness of the thought.
- VI. This investigation has been seriously affected by the fact, which comes out clearly in the course of it, that any adequate verbal expression, even for those who make a business of it, is dependent upon a motive for communication or expression.

APPENDIX.

Detailed description of experiments used in Mental Diagnosis.

I. Reading of descriptive passages.

First five read silently as nearly normally as possible:

1. There is a place in front of the Royal Exchange where the wide pavement reaches out like a promontory. It is the shape of a triangle with a rounded apex. A stream of traffic runs on either side, and other streets send their currents down into the open space before it. Like the spokes of a wheel converging streams of human life flow into this agitated pool. . . . Blue carts and yellow omnibuses, varnished carriages and brown vans, green omnibuses and red cabs, pale loads of yellow straw, rusty-red iron clanking on paintless carts, high white woolpacks, grey horses, bay horses, black teams; sunlight sparkling on brass harness, gleaming from carriage panels; jingle, jingle, jingle! A . . . jingle, too, of colour; flecks of colour champéd, as it were, like bits in the horses' teeth, frothed and strewn about. (Jefferies. *The Story of my Heart*, p. 87. Longmans, 1883.)

2. Throughout the winter of 1861-62, McClellan had under his immediate command double the force of the Confederate general, Joseph E. Johnston, but he could not be induced to take the field. In March, 1862, he at last assumed the offensive. Instead of maneuvering Johnston out of his fortified position, and attacking him on the first opportunity, McClellan decided to transport his army to the peninsula formed by the York and James rivers, and advance upon Richmond from the east instead of from the north. By pursuing this route, he would avoid crossing the Rappahannock, Rapidan, Pamunkey, and Mattaponi rivers, and would compel Johnston to abandon his camps near Bull Run and march southward to the defense of the Confederate capital. (pp. 507-509, Channing's *Students' History of the United States*. Macmillan, 1915.) This was followed in all cases by a reproduction, and in several cases by another passage of a similar

nature, to test the result when the subject was expecting to give a reproduction.

3. So she came holding her dress with one fair rounded arm, and her taper before her, tripping down the stair to greet Esmond.

"She hath put on her scarlet stockings and white shoes," says my lord, still laughing.

"Oh, my fine mistress! is this the way you set your cap for the captain!" She approached, shining smiles upon Esmond, who could look at nothing but her eyes. She advanced holding forward her head, as if she would have him kiss her as he used to do when she was a child.

"Stop," she said, "I'm grown too big! Welcome, Cousin Harry," and she made him an arch courtesy, sweeping down to the ground almost, with the most gracious bend, looking up the while with the brightest eyes and sweetest smile. (*The History of Henry Esmond*, Bk. II, ch. 7.)

4. Who hath smelt wood smoke at twilight?

Who hath heard the birch log burning?

Who is quick to read the noises of the night?

Let him follow with the others, for the young men's feet
are turning

To the camps of proved desire and known delight.

(Kipling. *The Feet of the Young Men*.)

This was followed in all cases by a reproduction.

5. Ah, bitter chill it was!

The owl for all his feathers was a-cold;

The hare limped trembling through the frozen grass,

And silent was the flock in woolly fold;

Numb were the Beadsman's fingers, while he told

His rosary, and while his frosted breath,

Like pious incense from a censer old,

Seem'd taking flight to heaven without a death,

Past the sweet Virgin's picture, while his prayer he saith.

(Keats. *Eve of St. Agnes*.)

This was used in a few cases only, where the results of 4 were not good.

Two read aloud by the subject:

6. Then I rested, sitting by the wheat; the bank of beach was between me and the sea, but the waves beat against it; the sea was there, the sea was present and at hand. By the dry wheat I rested, I did not think, I was inhaling the richness of the sea, all the strength and meaning of the sea and earth came to me again. I rubbed out some of the wheat in my hands, I took up a piece of clod and crumbled it in my fingers—it was a joy to touch it—I held my hand so that I could see the sunlight gleam on the slightly moist surface of the skin. (Jefferies. *The Story of My Heart*, p. 113. Longmans.)

7. Time, now that the deed was accomplished—time, which had closed for the victim, had become instant and momentous for the slayer. . . . The thought was yet in his mind, when, first one and then another, with every variety of pace and voice—one deep as the bell from a cathedral turret, another ringing on its treble notes the prelude of a waltz—the clocks began to strike the hour of three in the afternoon.

The sudden outbreak of so many tongues in that dumb chamber staggered him. He began to bestir himself, going to and fro with the candle, beleaguered by moving shadows, and startled to the soul by chance reflections. In many rich mirrors, some of home design, some from Venice or Amsterdam, he saw his face repeated and repeated, as it were an army of spies his own eyes met and detected him; and the sound of his own steps, lightly as they fell, vexed the surrounding quiet. . . .

The faint, foggy daylight glimmered dimly on the bare floor and stairs; on the bright suit of armor posted, halberd in hand, upon the landing; and on the dark wood-carvings, and framed pictures that hung against the yellow panels of the wainscot. So loud was the beating of the rain through all the house that, in Markheim's ears, it began to be distinguished into many different sounds. Footsteps and sighs, the tread of regiments marching in the distance, the chink of money in the counting, and the creaking of doors held stealthily ajar, appeared to mingle with the patter of the drops upon the cupola and the gush-

ing of the water in the pipes. The sense that he was not alone grew upon him to the verge of madness.

(Stevenson. *Markheim*.)

Two read by the investigator to the subject:

8. Imagine two steel knife blades with their keen edges crossing each other at right angles, and moving to and fro. (Used by Miss Fernald. James. *Psychology* II. p. 452.)

9. (In cases where *Markheim* was familiar selections from other short stories were used.)

Presently the notes of a piano were awakened to the music of a hymn, and the voices of many children took up the air and words. How stately, how comfortable was the melody! How fresh the youthful voices! *Markheim* gave ear to it smilingly as he sorted out the keys, and his mind was thronged with answerable ideas and images—churchgoing children and the pealing of the high organ; children afield, bathers by the brookside, ramblers on the brambly common, kite-flyers in the windy and cloud-navigated sky; and then, at another cadence of the hymn, back again to church, and the somnolence of summer Sundays, and the high genteel voice of the parson (which he smiled a little to recall), and the painted Jacobean tombs and the dim lettering of the ten commandments in the chancel. (Stevenson. *Markheim*.)

II. Spelling backwards, and pronouncing from words spelled backwards.

1. Spelling backwards.

Oral	Written
1. friendliness	sequestered
2. substitute	equivalent
3. assurance	credibility
4. simplicity	utterance
5. cylindrical	temperament
6. vivacious	mischief
7. manuscript	reverence
8. insatiable	witchcraft
9. heterogeneous	promiscuous
10. intersperse	fictitious

The time was taken by the stopwatch from the moment of pronunciation to the spelling of the last letter.

2. Pronouncing from words spelled backwards.

One letter per second.

1. glance
2. identical
3. broadens
4. chasm
5. equipment
6. Ethel
7. mobilization
8. solve
9. quotient
10. system
11. mathematics
12. grammarian
13. literature
14. linguistic
15. democrat
15. progressive
17. implicit
18. Hungary
19. fashion
20. fundamental

Two letters per second

- assertion
- analytic
- attached
- amiable
- Belgium
- pronounce
- abbreviate
- principle
- raises
- potential
- salamander
- equivalent
- exclamation
- rudimentary
- homogeneous
- genuine
- conclusion
- definition
- Michigan
- symmetry

The time was taken from the speaking of the first letter to the beginning of pronunciation.

III. Memory of various kinds of symbols. Exposed for 10 seconds.

Six items

1. Z 2 V
6 0 N

2. 8 XL 4
VI 3 ii

Nine items

3. h VII A
4 s
H IV 1

4. 6 V 9
X 3 VII
2 8 IV

5. 5 XL 7
3 o IX
16 VIII XI

6. B 4 t
= m XI
iii \ 1

IV. Memory of words alike in sound but not in appearance.

Exposed for 15 seconds.

Test a.	cent	rays	cite
	raise	site	sent
	sight	raze	scent
Test b.	pair	air	you
	ere	yew	pear
	ewe	pare	heir
Test c.	so	rein	sow
	I	sew	rain
	reign	eye	aye

V. Word lists.

i. Rhyming lists. One minute allowed to write all words

which occurred as rhyming with a given word. All lengths and proper names allowed. Words: home, speak, case, hope, low.

2. Lists of words grouped according to spelling. Time, one minute. Endings used: -one, -ough, -ose, -ave, -ine.

3. Lists of words from endings given, as in 2, grouped in columns according to sound. Time, two minutes. Endings used: -are, -ove, -ear, -ead, -oth.

VI. Memory of words spelled alike but pronounced differently.

1. Words read once by experimenter and reproduced orally by subject.

wīnd	līves	rōw
bāss	māll	līves
rōw	wīnd	bāss

2. Words read once by experimenter to subject, who follows on a list which he holds, of the same words with no indication of their pronunciation. He then thinks through the words once with the list still before him, and reads them aloud from the list. All he is asked to do is to keep the auditory difference between the words.

lēad āye dōve bōw aȳe dōve lēad bōw rēad

VII. Memory of pictures. Experiment as first used drawn from Miss Fernald's work.

1. 8 picture postals, 4 colored, 4 uncolored, exposed for 10 seconds each. To be described as fully as possible. Introspections taken to throw light on methods of learning and of recall.

2. 8 picture postals, all colored, exposed for 10 seconds each. 4 described immediately, 4 after another experiment has been done.

Experiment as used later. Cards, both colored and uncolored, were shown for periods of 2, 4, and 10 seconds. Some of each of these were recalled after a week's interval.

THE FREE WORD ASSOCIATION TEST.

The material from this test was arranged for study in such a way as to give on a single line the stimulus word, its part of

speech, its type (objective, sensuous, or the like), its known associations (as with previous experiments), the reaction word, its part of speech and type, the type of the reaction (information drawn from introspections), and the reaction time. The list of words is given below. The abbreviations indicate the probable type of the word: Ab.—abstract, ob.—objective, s.—sensuous, at.—attributive, con.—connotative.

- | | | |
|--------------------------|---------------------------|--------------------------|
| 1. florid—at. | 39. Hall—ob. or con. | 76. analyze—ab. |
| 2. twilight—con. | 40. comely—at. | 77. sultry—s. |
| 3. fly—ob. | 41. lake—ob. | 78. equivalent—ab. |
| 4. chill—s. | 42. omnibuses—ob. or con. | 79. sumptuous—at. |
| 5. prose—ab. | 43. 1861-62—cn. | 80. rhea—ob. |
| 6. quince—ob. | 44. also—ab. | 81. bugle—ob. |
| 7. critical—ab. | 45. woolly—s. | 82. tide—con. or ob. |
| 8. rippling—s. | 46. dichotomy—ab. | 83. sesquipedalian—ab. |
| 9. treasure—con. | 47. cling—con. | 84. grim—at. |
| 10. over—ab. | 48. majestic—at. | 85. jingle—s. |
| 11. drab—s. or at. | 49. medium—ab. | 86. dusky—s. or at. |
| 12. hum—s. | 50. paddle—ob. | 87. animated—at. |
| 13. brook—ob. | 51. vagrant—con. | 88. knifeblades—ob. |
| 14. wind—ob. | 52. heterogeneous—ab. | 89. isobar—ab. |
| 15. wit—ab. | 53. clock—ob. | 90. yes—ab. |
| 16. briskly—at. | 54. dive—ob. | 91. conterminous—ab. |
| 17. hall—ob. | 55. tapir—ob. | 92. punch—s. or ob. |
| 18. Orpheus—con. | 56. pale—s. or at. | 93. eighty—ab. |
| 19. remember—ab. | 57. myriad—con. | 94. grate—ob. |
| 20. silvery—s. | 58. spread—ob. | 95. hyacinth—ob. or con. |
| 21. severe—at. | 59. murmur—s. | 96. assimilate—ab. |
| 22. come—ob. | 60. gem—ob. or con. | 98. enjoyed—at. |
| 23. hard—s. or at. | 61. streaming—s. or at. | 99. incommensurable—ab. |
| 24. frog—ob. | 62. inculcate—ab. | 100. gray—s. |
| 25. savoursome—s. | 63. lapping—s. | 101. moist—s. |
| 26. broadens—ab. | 64. due—ab. | 102. distribute—ab. |
| 27. olivaceous—ab. or s. | 65. golden—s. | 103. wended—con. |
| 28. culture—ab. | 66. jeopardy—con. | 104. lawns—ob. |
| 29. courtesy—con. | 67. chattered—con. | 105. host—con. |
| 30. scarlet—s. | 68. arcade—ob. | 106. bliss—con. |
| 31. function—ab. | 69. low—at. | 107. dyes—ob. |
| 32. maple—ob. | 70. Japanese—at. | 108. serene—at. |
| 33. reading—ob. | 71. logical—ab. | 109. turf—con. |
| 34. humble—at. | 72. chink—con. | 110. vast—at. |
| 35. carrot—ob. | 73. tired—at. | 111. piping—s. |
| 36. bell—ob. | 74. eggs—ob. | 112. extract—ab. |
| 37. mirrors—ob. or con. | 75. blue—s. | 113. cinnamon—s. or ob. |
| 38. braes—con. | | |

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